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With warm regards,

(Debal C Kar)

Viability of product imports via pipeline into the Northern Region

Prepared for **Hindustan Petroleum Corporation Ltd.**

September 2002

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1

Introduction

HPCL is going ahead with its 9 MMTPA Bhatinda refinery project in Phulo Khari, Punjab. The project also includes a 140 MW captive power plant, a port at Mundra in Gujarat for importing crude oil and a crude oil pipeline for transporting the crude oil from the import terminal to the jetty. The company expects to commission the project by 2006/7.

Project background

HPCL received the first stage approval of Government of India for preparation of Detailed Feasibility Report (DFR) for 6 MMTPA refinery in 1997. Later on, in November 1998, anticipating an increase in demand of petroleum products in the Northern region, DFR was submitted by the company for the stage II investment approval for a refinery with a capacity of 9 MMTPA. The market analysis in terms of demand and supply projections for petroleum products given in that DFR were updated by TERI in 2000. The product surplus/deficit projections for all India and Northern region in specific were covered in the analysis.

With the recent developments taking place in the oil sector, HPCL felt the need to revisit the likely refining capacities and demand projections for petroleum products to assess the demand-supply balances of the key petroleum products in the northern region. Additionally, this study is also examining the viability of importing products into this region by assessing the feasibility of using the proposed pipeline from Mundra to Bhatinda as a products pipeline to service the demand of the north-west corridor. The pipeline is expected to be commissioned by 2005/6.

Specifically, the terms of reference for the study are as follows:

1) Demand for key petroleum products (LPG, MS, Naphtha, ATF, SKO, HSD, and FO/LSHS) for all India and for the northern[a] region till the terminal year of XI Plan

---

[a] States of Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, Chandigarh, Uttranchal, Rajasthan, and Uttar Pradesh

2) Supply of key petroleum products in the northern region from existing and proposed refinery capacity
3) Resultant demand-supply balances for petroleum products in the northern region
4) Likely capacity utilization[a] of pipeline from emergent demand-supply analysis
5) Freight economics of pipeline vis-à-vis other transportation modes

For the purpose of this report, India has been divided into 4 regions each including a number of states. These regions are:

- Northern region
- Western region
- Eastern region (including North-Eastern region)
- Southern region

where Northern region covers Punjab, Haryana, Delhi, Chandigarh, Uttaranchal, Rajasthan, Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh. The report provides estimates for all India and further for the four regions.

The study plan

The study was planned as follows-

Step 1 - Demand assessment

The first step is forecasting the demand for seven petroleum products – MS, HSD, SKO, FO/LSHS, Naphtha, ATF and LPG. This exercise is done on an all-India basis and the region wise estimates are obtained by prorating the demand forecasts according to previous years' actual sales figures. However, demand assessment for naphtha and fuel oil/LSHS is done on a micro-economic scale, taking into account the individual bulk users of naphtha and as such does not require proration. This analysis is presented in Chapter 2.

Step 2 - Supply assessment

Second step is to assess the supply of these products for the northern region. As detailed later in the report, two supply cases are built based on different assumptions regarding the conversion of Kandla Panipat section of the Kandla Bhatinda product pipeline (KBPL) into a crude carrier. This decision by IOC will impact not only the refinery expansions in the region but will have an impact on the overall supply scenario in the region since large amount of petroleum products are moved into the northern region by KBPL.

---

[a] With respect to MS, HSD and SKO

The refinery throughputs are taken as 95% of the installed capacity of these refineries. This is due to the fact that many Indian refineries have been operating at more than their rated capacities in the past. But with refining capacity exceeding the demand for products, as is the case in the recent past, the refineries are expected to run below their full capacities in the deregulated scenario. This analysis forms the subject matter of Chapter 3.

Step 3 - Demand supply balances

Product balances are then estimated for all the regions by juxtaposing the demand and supply from refineries of petroleum products in order to identify the possible inter-regional movements, especially in "white oils" – MS, HSD and SKO. Chapter 4 presents the results of this section.

Step 4 - Detailed market analysis

This final step factors the delivered price of HSD at the identified depots by each possible source by the way of a transportation model which identifies the supply source that will be used to serve a particular depot. This analysis will bring out the probable market share of each supply source in the "designated area". Chapter 5 brings out the results of this exercise.

The report ends with a chapter on key conclusions followed by annexures.

2

Demand projections

Demand projections for petroleum products, in this report, pertain to liquefied petroleum gas (LPG), naphtha, motor spirit (MS), aviation turbine fuel (ATF), superior kerosene oil (SKO), high speed diesel (HSD) and furnace oil/low sulphur heavy stock (FO/LSHS). In 1999/00, these accounted for about 92% of the total petroleum products sold in the country. The projections are made for the period 2002/3 to 2011/12 covering the tenth and the eleventh plan periods. Projections presented in the subsequent sections indicate unconstrained demand, i.e., these ignore supply/logistics and administrative constraints, etc.

Liquefied petroleum gas (LPG)

LPG is primarily used as a domestic fuel with a limited usage in industrial/commercial sector. Demand projections for LPG have, thus, been separately modelled for domestic and industrial/commercial sectors. Recently the government allowed use of LPG as a fuel for automobiles. However, amendments to various acts like the Motor Vehicles Act is still pending. In addition, retailers have cited problems regarding arrangements for dispensing this product. Moreover, the centre has still to come out with the approval of LPG kits to be used by motor vehicles. The demand for LPG originating from the automobile sector has been analysed separately based on the vehicular population projections and expected penetration rate of LPG vehicles.

Domestic demand

Demand for LPG for domestic use has been estimated from a demographic model that essentially computes the number of potential LPG consumers at a given point in time, which in conjunction with the figure for LPG requirement per household yields the total demand for LPG at that point of time.

On account of the variations in consumer demographics across the country, the analysis was carried out at a state level and the results were pooled together to arrive at a regional and national level estimates for LPG demand.

Data on consumer expenditure patterns was sourced from results of National Sample Survey Organisation (NSSO) rounds on consumer expenditure, the latest being the 55th round. The NSSO data categorises state populations into fractile classes (accounting for 10% of the populations each) in ascending order of Monthly Per Capita Expenditure (MPCE). These are available separately for urban and rural areas. Consumer expenditure tabulated as MPCE, is further sub-categorised into twenty different categories, which includes amongst others, the expenditure on fuel and light.

In order to estimate the potential consumers for LPG, MPCE on cooking fuels alone was isolated from the components of the fuel and light expenditure. Based on the prevailing LPG price and LPG consumption per capita, per capita cost of LPG usage was estimated. A person was considered to be a potential consumer if his target cooking expenditure exceeded the cost of using LPG. The aggregate of all such potential consumers indicated the potential LPG consumer population. The product of the potential consumer population and LPG consumption per capita yielded the potential demand for LPG for the domestic use.

Industrial/commercial demand

Out of the total industrial and commercial folio, three sectors, namely, hotels & restaurants, chemicals (including petrochemicals, fertilisers, pesticides, other organic chemicals) and industries such as glass, ceramics, rubber tyres, plastics etc account for over 70% of total LPG bulk consumption.

Industrial/commercial LPG sales are highly localised. Six industrial regions viz., Vadodara (Gujarat), Ernakulam (Kerala), Vishakhapatnam (Andhra Pradesh) and Mumbai, Thane & Pune (all in Maharashtra), together account for 57% of the LPG industrial consumption. In this respect, the LPG industrial/commercial demand pattern is highly skewed at present. Since the regional estimates of bulk LPG demand are derived from the actual sales for the year 1999/00, this fact is well represented in the forecasts.

Demand projections for industrial/commercial users are related to the overall performance of the economy, measured by the GDP, which showed significant statistical correlation with past bulk sales of LPG. The projections are derived assuming a GDP growth rate of 6.5%.

Aggregate LPG demand

LPG demand in the country grew at an annual rate of 10.6% during the period 1991/92-1998/99. The aggregate LPG demand potential is expected to grow at an annual rate of 8.1% during the period 2002/3 to 2011/12. While the demand growth in the industrial/commercial sector at 8.39% p.a. exceeds that in the domestic segment at 4.28%, the demand from the industrial/commercial segment accounts for only 20% of the total potential in 2011/12. The results are summarised in Table 2.1.

Table 2.1 Projected aggregate LPG demand (TMT)

Year	Domestic	Industrial/ Commercial	Auto LPG	Total
2002/03	7563	1376	27	8966
2003/04	7924	1499	44	9467
2004/05	8296	1631	64	9991
2005/06	8677	1779	88	10544
2006/7	**9072**	**1919**	**115**	**11106**
2007/8	9474	2078	145	11697
2008/9	9885	2247	181	12313
2009/10	10302	2427	220	12949
2010/11	10728	2618	266	13612
2011/12	**10974**	**2822**	**317**	**14113**

Naphtha

Fertiliser, petrochemical and power sectors are the major consumers of naphtha in the country. The shares of these industries in naphtha consumption are shown below.

Table 2.2 Sector wise consumption of naphtha (including imports) *(TMT)*

Sector	1998/99	1999/00	2000/1
Fertilizers	3854	3891	3873
Petrochemicals	3816	4229	4899
Power/Steel	1649	2558	2906
Total	**9319**	**10678**	**11678**

Source. MoPNG

Demand projections for naphtha are derived separately for these three sectors.

Projections for fertiliser industry

The total installed urea capacity in the country is about 20 MMTPA of which 58% is based on gas, 25% on naphtha and 10% on FO. 4% of total capacity is dual fuel using either naphtha/FO or naphtha/gas and the rest is based on coal. Urea consumption has not grown at the same rate as production and hence imports have come down from 2.4 million tonnes in 1997/98 to half a million tonnes in 1999/00. There were no urea imports last year.

In such a scenario, demand for naphtha from the fertiliser sector will rise if new capacity based on naphtha is brought on line. On the other hand, the naphtha consumption of the fertiliser sector will decline if no new naphtha based capacity is planned and if existing naphtha based units shift to gas as and when gas becomes available. Thus, availability of natural gas becomes important in projecting naphtha demand in the country.

Availability of natural gas

Currently, entire gas production of the country has been tied in allocation to various consumers. Hence, no gas can be expected from current production to the new fertiliser plants or for the plants that are expected to shift to gas. Thus, additional gas availability becomes important if these plants are to shift to gas.

Many LNG terminals have been planned all along the Indian coastline to cater to the huge and growing demand for gas in the country. However, considerable progress has been reported at Shell's LNG terminal at Hazira and Petronet's Dahej terminal of capacities 2.5 and 5 MMTPA respectively. Gas from these terminals can be delivered from 2005/6. Enron's LNG terminal at Dabhol made considerable progress but work has now almost stopped due to dispute over the 2100 MW power plant which the terminal was suppose to cater to. But it is unlikely that this investment will go waste. LNG terminals have been planned at Kochi, Ennore and Kakinada but no significant progress has been reported.

Apart from these LNG terminals, additional quantity of gas is expected from various fields awarded under various NELP initiatives. It is estimated that such fields will generate about 2 MMSCMD of natural gas in Gujarat and 5 MMSCMD of gas in Andhra Pradesh by the year 2003/4.

However, the eastern region of the country is not expected to get additional gas either from LNG or from NELP discoveries during the study period. But, on the other hand, the domestic gas availability is projected to decline in the future so that the demand for naphtha to substitute for gas will increase in this region.

New naphtha based units

There are seven new urea units planned in the country at Thal, Nellore, Hazira, Gorakhpur, Sangrur, Haldia and one in Andhra Pradesh. Of these, the first four can be expected to come on line by 2006/8 while the date of commissioning of last three is still uncertain and hence are not considered in the analysis. However, Thal and Hazira are in the position to use gas that could be made available in the form of LNG while Nellore can use the additional domestic availability from the NELP fields. Indications are that even the plant at Gorakhpur will also use gas as and when it becomes available. Hence, no new naphtha based unit is envisaged in the near future. Though additional infrastructure in the form of pipelines will be required to cater to these units, gas is still likely to be competitive with naphtha at these locations.

Conversion from naphtha to gas/LNG

Availability of gas in the form of LNG at Gujarat will make it possible for naphtha based units at Panki, Phulpur, Kota and Gadepan to shift to gas as gas from Petronet's Dahej LNG terminal will be fed into the HBJ pipeline which will be extended to cater to these plants along with enhancement in capacity.

Presently, restricted availability of gas is forcing many fertiliser units like Tata Babrala, IGFCC Jagdishpur, IFFCO Kalol, GSFC Baroda, NFL Vijaipur and KRIBHCO Hazira, to use naphtha sporadically. Increased availability of gas in the form of LNG and NELP gas is expected to ease the situation and accordingly these units will completely use gas for urea production.

Thus, naphtha demand originating from the fertiliser sector can be projected as follows.

Table 2.3 Naphtha demand from fertiliser sector*(TMT)

Year	Demand
2002/03	3873
2003/04	3873
2004/05	3873
2005/06	2750
2006/07	1730
2007/08	1730
2008/09	1730
2009/10	1730
2010/11	1730
2011/12	1730

Projections for the petrochemicals sector

The petrochemical industry enjoyed high growth rates during the 1990s. The consumption of polymers grew at 14% during the decade while production grew at 25% as a result of which there was considerable excess capacity in the sector at the end of 2000/01. Due to the strong demand for petrochemicals experienced during the decade, a number of new plants were cleared. These are as follows.

Table 2.4 New petrochemical plants cleared

Plant (Location)	Capacity (000TPA)
PSIDC Punjab	300
Auraiya	300
MPSIDC	300
Haldia	420
RIL Assam	300
Baroda	130-300
Jamnagar	800
Gandhar	300
Hazira	750
Thane	75-300
Nagothane	300-400
KSIDC Mangalore	300
TIDCO	300
Sh.Krishna PC	300

However, in the view of excess capacity in the sector, there is little possibility of these units coming on line in the next two planning periods. Thus we have assumed a 5% per annum growth rate in naphtha demand from petrochemicals sector as projected by the Chemical Manufacturer's Association (CMA). It is expected that Reliance will expand its capacity from 750 TMT to 1000 TMT by 2007/8, IPCL will expand from 130 TMT to 300 TMT by 2008/9 and NOCIL will expand from 75 TMT to 300 TMT in 2009/10 but these will be covered within the 5% growth rate.

The naphtha demand from the petrochemical sector is thus projected as follows:

Table 2.5 Naphtha demand from the petrochemical sector (TMT)

Year	Demand
2002/03	5400
2003/04	5670
2004/05	5953
2005/06	6251
2006/07	6564
2007/08	6892
2008/09	7236
2009/10	7598
2010/11	7978
2011/12	8377

Projections for the power sector

In 1997, the government of India set a target of 12000 MW of capacity to be installed on naphtha under its Liquid Fuel Policy. However, only 2000 MW of capacity has materialised till date due to factors like high cost of naphtha and variability in price. Even after adjusting for the concessional duty structure for naphtha use by power sector, gas is likely to be competitive with naphtha at all locations. Thus, it is expected that power plants using naphtha will shift to gas as and when the gas is available.

Based on the profile of availability of gas given above, the following plants are expected to shift to gas in due course.

Table 2.6 Power plants expected to shift to gas

Power plant	Current naphtha off take	Source of LNG	Expected year of shift
Essar power	39 TMT	Petronet Dahej	2005
NTPC Kayamkulam	342 TMT	Petronet Cochin	Uncertain
APGPCL	89 TMT	Local gas	2004
BSES	36 TMT	Local gas	2004
Dabhol	577 TMT	Dabhol	2003
LANCO	157 TMT	Local gas	2001

As such, a declining naphtha demand from the power sector is envisaged as follows.

Table 2.7 Demand for naphtha from power sector (TMT)

Year	Demand
2002/03	2750
2003/04	2173
2004/05	2048
2005/06	2009
2006/07	2009
2007/08	2009
2008/09	2009
2009/10	2009
2010/11	2009
2011/12	2009

Demand to meet gas shortage

However, the supply of gas from existing domestic fields is projected to come down. This is shown in the Table below.

Table 2.8 Supply of domestic gas *(mmcmd)*

Year	2000/1	2005/6	2011/12
Gujarat	6.09	3.78	0.68
Hazira	36.51	42.31	32.29
Uran	10.51	8.02	0.71
Andhra Pradesh	7.51	6.95	0.99
Others	5.64	7.66	4.95
Total	66.26	68.72	39.62

Note The shortage at Uran starts after 2003/4

Source. ONGC

In Gujarat and along the HBJ pipeline, LNG would meet the gas shortfall after 2005. In Andhra Pradesh, there are indications that local gas discoveries will make up for the shortage. In Maharashtra, the Dabhol project is in difficulties. However, we assume that LNG would be available by 2003/4.shortage will have to be met by naphtha. The consequent demand for naphtha would be as below.

Table 2.9 Gas shortage and naphtha demand *(TMT)*

Year	2001/ 2	2002/ 3	2003/ 4	2004/ 5	2005/ 6	2006/ 7	2007/ 8	2008/ 9	2009/ 10	2010/ 11	2011/ 12
Gujarat	-	-	130	310	-	-	-	-	-	-	-
Hazira	-	-	-	-	-	-	-	-	-	-	-
Uran	-	-	-	-	-	-	-	-	-	-	-
AP	-	-	-	-	-	-	-	-	-	-	-
Assam/TN	-	-	-	-	-	130	260	390	520	650	780
Total	-	-	130	310	-	130	260	390	520	650	780

Naphtha requirement has been calculated based on thermal equivalence assuming a calorific value of 10,560 kcals/kg for naphtha and 8500 kcals/cu. mtr for gas.

Combining the naphtha demand from all the sectors yields the following total naphtha demand projections.

Table 2.10 Projections of naphtha demand (TMT)

Year	Demand
2002/03	12022
2003/04	11715
2004/05	11875
2005/06	11010
2006/07	10303
2007/08	10631
2008/09	10976
2009/10	11337
2010/11	11717
2011/12	12116

Motor spirit

The MS demand is restricted to the transport sector, primarily to the personalised modes of transport i.e. cars and two wheelers and inter-mediate transportation modes like taxis and three-wheelers. The demand for MS thus depends upon their vehicle populations.

Trends in vehicle populations for these personalised modes were analysed and a strong correlation coefficient between vehicle populations and per capita income levels was established. Further based on per capita income levels, vehicle population projections were made. The population of personalised modes of transport is projected to grow at a rate of about 9% till the year 2011/12. Further an assessment on the penetration of alternative fuels such as CNG and LPG in personalised modes of transport in the future was made and their impact on MS consumption was incorporated. The MS demand estimates arrived at indicate an annual increase of about 7.1% during the period 2001/02-2011/12. The demand projections of MS are presented in the Table below:

Table 2.11 Projected demand for motor spirit (TMT)

Year	*Demand*
2001/02*	6931
2002/03	6970
2003/04	7566
2004/05	8194
2005/06	8869
2006/07	9576
2007/08	10320
2008/09	11106
2009/10	11934
2010/11	12822
2011/12	13749

* Actual sales

Aviation turbine fuel (ATF)

Air traffic in India is characterised by both domestic as well as international airlines. However, while the domestic airlines source the fuel indigenously, international carriers choose the most economical source, which may be outside the country. In that case, the proportion of air traffic represented by international carriers will have marginal effect on the ATF sales in the country.

The prices of ATF were deregulated last year which brought down the prices in line with the international rates thereby providing a level playing field for domestic airlines and at the same time enticing the international airlines to source ATF from India by reducing the disparity in international prices and domestic prices. The government also exempted the foreign airlines from paying the sales tax and other duties on ATF sourced in India that shall contribute to increased offtake of ATF from India by international carriers.

It is estimated that business traffic (including that from the Government) accounts for about 70% of the total air traffic, followed by foreign tourists in India accounting for another 20% and non-resident Indians visiting India accounting for about 7% of the total domestic traffic. Leisure/emergency travel accounts for a marginal 3% of the total traffic only.

Given this kind of demand structure, several variables indicating the level of activity in the economy were identified, inter alia, Gross Domestic Product (GDP), Gross Domestic Product of Industries, Manufacturing and Services, Index of Industrial Production etc. A regression model was constructed whereby the impact of each of these variables was analysed. The results showed that GDP along with GDP Manufacturing and GDP Industry came closest to explaining the past 20 years of trend in ATF sales. But GDP Manufacturing and GDP Industry were itself closely correlated with GDP. Thus, GDP was taken as the independent variable effecting the ATF demand and an annual growth rate of 6.5% was assumed to project the ATF demand in the country, which is shown below.

Table 2.12 Projections for ATF demand in the country (TMT)

Year	Demand
2002/03	2524
2003/04	2624
2004/05	2728
2005/06	2836
2006/07	2949
2007/08	3066
2008/09	3187
2009/10	3313
2010/11	3445
2011/12	3581

Superior kerosene oil (SKO)

The demand for kerosene is primarily restricted to the domestic sector. The use of kerosene for cooking is negligible in rural areas and is fairly low in the urban areas as well. The urban share is further likely to reduce in the future with the increasing LPG availability.

In order to project SKO demand, trends in kerosene sales over last few years were analysed. It was observed that the kerosene consumption has declined from 11.1 MMT in 1997/98 to 9.9 MMT in 2001/02, indicating a negative growth rate of 2.56% per annum. Assuming the same decline in growth rate till the end of X five year plan (2006/07) and further till the end of XI five year plan (2011/12), the following demand figures are projected as given in the table below:

Table 2.13 Projected demand for Kerosene (TMT)

Year	Demand
2001/02*	9970
2002/03	9919
2003/04	9867
2004/05	9816
2005/06	9765
2006/07	9714
2007/08	9664
2008/09	9614
2009/10	9564
2010/11	9514
2011/12	9464

* Actual sales

High speed diesel (HSD)

HSD sales account for about 43% of the total petroleum product sales in India. It is used in different sectors including transport, agriculture and industries and includes both direct and retail sales. Direct sales include those to industrial consumers, food processing units, state road transport undertakings (SRTUs), aviation, shipping and railways and together account for only 24% of the total sales. Bulk of HSD sales are accounted for by the retail trade mainly in the transport sector (76%).

However, due to paucity of information on the share of various components of the retail trade, various indices of the economy over years were analysed. The relationship between HSD consumption and various indices of economic development such as index of area under crops, industrial production and transport equipments was developed. Finally, based on high correlation coefficient between HSD sales and index of transport equipments, HSD demand was estimated using 6.3% compound annual growth rate till the year 2011/12. The aggregate demand estimates for HSD is summarised in Table below.

Table 2.14 Projected demand for HSD (TMT)

Year	Demand
2001/02*	34424
2002/03	44135
2003/04	46765
2004/05	49594
2005/06	52637
2006/07	55911
2007/08	59432
2008/09	63219
2009/10	67293
2010/11	71675
2011/12	76389

* Actual sales

Furnace oil (FO)/LSHS

FO/LSHS consumption can be bifurcated in two categories – General trade and Plant specific consumption. Power, petrochemical, fertiliser and steel are the major industries consuming FO/LSHS apart from general trade. Due to a constant decline in the plant specific fuel oil consumption and due to a constant rise in general trade, the share of latter has risen from 36% to 55% over the past decade. Western region followed by southern region, accounts for bulk of plant specific as well as general trade consumption of fuel oil in the country.

FO/LSHS use for power generation is primarily concentrated in the western region of the country with two bulk consumers being Gujarat Electricity Board's fuel oil based plant at Dhuvaran and Tata Electric Company's plant in Mumbai.

FO/LSHS demand for fertiliser production is primarily concentrated in the northern region on account of NFL's fuel oil based plants at Nangal, Bathinda and Panipat. Other major consumers include FCI's plant at Sindri in the East, GNFC in the West and SPIC and FACT in the southern region. No new fuel oil based fertiliser plant is envisaged during the projection period.

The forecast for fuel oil consumption in the country for the coming decade is accordingly structured in two parts. It is assumed that the plant specific consumption in the country will not grow due to increased competition from gas.

The general trade in fuel oil is accounted for by numerous small industrial units either in production process, such as by glass industries, or for captive power generation. Availability of substitutes for such units is limited and hence they will remain dependent on FO/LSHS. The usage of FO/LSHS by these units have been linked to the general GDP growth rate which reflects the value added in the economy. The regression model shows a high regression co-efficient, which indicates a good fit. Assuming a baseline GDP growth rate of 6.5%, the general trade fuel oil demand in the country is forecasted as follows:

Table 2.15 Projected demand of fuel oil by general trade (TMT)

Year	Demand
2002-03	7941
2003-04	8607
2004-05	9328
2005-06	10110
2006-07	10958
2007-08	11877
2008-09	12873
2009-10	13952
2010-11	15122
2011-12	16390

Adding the current level of plant specific fuel oil consumption gives the total fuel oil demand forecast for the country.

Table 2.16 Projections of fuel oil demand (TMT)

Year	Demand
2002-03	13174
2003-04	13840
2004-05	14561
2005-06	15344
2006-07	16191
2007-08	17110
2008-09	18106
2009-10	19185
2010-11	20355
2011-12	21623

Regional demand

The regional demand for the above mentioned petroleum products (except naphtha and FO/LSHS) has been estimated by apportioning the regional shares in the total sales for all products in the year 1999/00.

The northern region comprises the states of Jammu & Kashmir, Punjab, Haryana, Himachal Pradesh, Delhi, Rajasthan, the Union Territory of Chandigarh, Uttaranchal and Uttar Pradesh.

Under the above-mentioned assumptions, regional demand for petroleum products in 2006/07 and 2011/12 is summarised in Tables 2.17 and 2.18 respectively.

Table 2.17 Regional demand of select petroleum products: 2006/07 (TMT)

Region	LPG	MS	Naphtha	ATF	SKO	HSD	FO	Total*
Northern Region	**3755**	**3315**	**235**	**1153**	**2581**	**19443**	**3485**	**33967**
Southern Region	3140	2630	1777	539	2075	15113	4716	29990
Eastern Region	1158	926	1367	275	2224	7225	1317	14492
Western Region	3053	2705	7054	981	2833	14129	6674	37429
Total	**11106**	**9576**	**10433**	**2838**	**9713**	**55910**	**16192**	**115878**

- Sum of the listed seven products only

Description of states[a]-

- Northern Region: Comprises of the states of Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh (West) & the Union territory of Chandigarh
- Southern Region: Comprises of the states of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and the Andaman & Nicobar Islands
- Eastern Region: Comprises of the states of Orissa, Bihar, West Bengal and the North Eastern States of Arunachal Pradesh, Assam, Manipur, Meghalya, Mizoram, Nagaland, Sikkim and Tripura.
- Western Region: Comprises of the states of Goa, Gujarat, Madhya Pradesh and Maharashtra.

Table 2.18 Regional demand of select petroleum products: 2011/12 (TMT)

Region	LPG	MS	Naphtha	ATF	SKO	HSD	FO	Total*
Northern Region	**4702**	**4760**	**260**	**1401**	**2515**	**26564**	**4624**	**44826**
Southern Region	3960	3776	2307	655	2022	20649	6295	39664
Eastern Region	1413	1330	1854	334	2167	9872	1754	18724
Western Region	4037	3884	8475	1192	2760	19305	8950	48603
Total	**14113**	**13750**	**12896**	**3582**	**9464**	**76390**	**21623**	**151817**

* Sum of the listed seven products only

Clearly, the western region leads the other regions in terms of the aggregate demand for petroleum products. Demand in the north closely trails the demand in the western region.

Further, HSD sales continue to dominate the demand for petroleum products in the country and in the northern region.

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[a] Though many states have now been bifurcated, this aspect does not affect our analysis detailed in rest of the chapters.

3

Supply sources

There are two possible sources of petroleum products supply for the northern region. One is the refining capacity in the region itself and the product pipelines, that may move the excess products supply from surplus region to the deficit region is another.

One major event on which the supply scenario in the North depends is the conversion of the Kandla Panipat section of Kandla Bhatinda product pipeline (KBPL) into a crude pipeline. Currently, this pipeline is being used to move Reliance's Jamnagar refinery products into the deficit northern region. The conversion of KBPL into a crude carrier, apart from having an impact on the product movement to this region, will also decide the fate of expansion plans of IOC's Panipat and Koyali refineries since currently, the expansion plans of these refineries are hindered by lack of source of crude. The Salaya Mathura Pipeline (SMPL) is already running at full capacity and hence an additional source of crude is required to meet the increased demand of crude for the expanded refineries.

Given this uncertainty, two scenarios have been built with opposite assumptions about conversion of KBPL into a crude carrier. These scenarios are detailed below.

Present refining capacity

As of March 2002, the installed refining capacity in India was 115 MMT consisting of 17 refineries. All these refineries are in public sector excepting that of Reliance, which is privately owned, and MRPL refinery which is a joint venture between Birla and HPCL[a]. Of the rest, there exist seven refineries of IOC, two each of HPCL and CPCL and one each of BPCL, KRL, BRPL and NRL. Table 3.1 lists the refinery crude throughput against the installed capacity of all the refineries for the year 2000/01.

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[a] Recently however, the Birla group has decided to offload its stake in MRPL in the favour of ONGC. Since ONGC will be eventually increasing its stake in the project to over 50%, MRPL will also become a subsidiary of ONGC.

Table 3.1 Installed capacity and refinery throughputs in 2000/01 (MMT)

Refinery	Installed Capacity	Refining Throughput
Northern Region		
IOC, Mathura	8.00	7.13
IOC, Panipat	6.00	5.71
Southern Region		
MRL, Madras	6.00	6.05
CRL, Cochin	7.50	7.52
HPCL, Vishakh	7.50	6.41
MRL, Narimanam	1.00	0.58
MRPL, Mangalore	9.69	6.44
Eastern Region		
IOC, Barauni	4.20	3.12
IOC, Haldia	4.60	3.88
IOC, Guwahati	1.00	0.71
IOC, Digboi	0.65	0.68
BRPL, Bongaigaon	2.35	1.49
NRL, Numaligarh	3.00	1.45
Western Region		
BPCL, Mumbai	6.90	8.66
HPCL, Mumbai	5.50	5.58
IOC, Koyali	13.70	12.00
Reliance, Jamnagar	27.00	25.70
Total	114.60	103.11

Future refinery capacity

Tenth plan report on refining in the country projects the refining capacity at the end of tenth plan period at 220.74 MMTPA, thereby adding 106.08 MMTPA in the five year period. Given the fact that highest capacity added in a plan period was 54 MMTPA in the previous decades, this targeted addition appears to be ambitious. Moreover, slowing down of the economy since last year has forced many refinery capacity additions as well as expansion plans to be deferred. The projected refining capacity in this report thus takes into account the latest reports on the expansion plans as well as work in progress on new refineries to estimate the refining capacity during the study period.

As explained above, there is a lot of uncertainty regarding the status of Panipat and Koyali refinery expansions. These expansions are linked to the conversion of KBPL into a crude pipeline, a step IOC has been mulling over for some time. Presently, the industry opinion on this issue is divided with the critics calling for 'common carrier' principle being applied on all pipelines. But IOC seems adamant since according to its estimates, it would save around Rs 1000 crores and its' plans to expand the Panipat and Koyali refineries to 12 MMTPA and 18 MMTPA respectively are also dependent on this using KBPL as the source of crude oil.

Given this uncertainty on the issue, two scenarios of refinery capacity additions have been built. Case 1 is built on the premise that Kandla Panipat section of KBPL will be converted into a crude pipeline and hence Panipat and Koyali expansions will materialise along with few other expansions. Case 2 then is built on the opposite premise of non-conversion of Kandla Panipat section of KBPL into a crude carrier and hence precludes expansions of Panipat and Koyali refinery during the study period.

The details of expansions taken for the analysis along with their year of commissioning are given in table 3.2 and 3.3.

Table 3.2 Materialisation of refinery expansion proposals-Case 1

Refinery	Installed capacity (MMTPA)			
	Existing	Expanded	Addition	Year
Northern Region				
IOC, Panipat	6.00	12.00	6.00	2005/06
Southern Region				
MRL, Madras	6.00	9.00	3.00	2006/07
MRL, Narimanam	1.00	1.50	0.50	2002/03
Eastern Region				
IOC, Barauni	4.20	6.00	1.80	2005/06
IOC, Haldia	4.60	6.00	1.40	2006/07
BRPL, Bongaigaon	2.35	3.00	0.65	2006/07
Western Region				
BPCL, Mumbai	6.90	12.00	5.10	2006/07
HPCL, Mumbai	5.50	5.83	0.33	2002/03
IOC, Koyali	13.70	18.00	4.30	2006/07
Reliance, Jamnagar	27.00	33.00	6.00	2006/07
Total			29.08	

*HPCL's Punjab Refinery Project is not included.

Table 3.3 Materialisation of refinery expansion proposals-Case 2

Refinery	Installed capacity (MMTPA)			
	Existing	Expanded	Addition	Year
Southern Region				
MRL, Madras	6.00	9.00	3.00	2006/07
MRL, Narimanam	1.00	1.50	0.50	2002/03
Eastern Region				
IOC, Barauni	4.20	6.00	1.80	2005/06
IOC, Haldia	4.60	6.00	1.40	2006/07
BRPL, Bongaigaon	2.35	3.00	0.65	2006/07
Western Region				
BPCL, Mumbai	6.90	12.00	5.10	2006/07
HPCL, Mumbai	5.50	5.83	0.33	2002/03
Reliance, Jamnagar	27.00	33.00	6.00	2006/07
Total			18.78	

*HPCL's Punjab Refinery Project is not included.

As these tables show, no grassroots refinery has been considered in our analysis. There are presently plans for four grassroots refineries, excluding HPCL Bhatinda, and the status of all these is reviewed below.

Bina

The Bina refinery project was initially conceived as a joint venture between BPCL and Oman Oil Company (OOC) with each holding 26% equity. As BPCL does not have any refinery in central and northern India, it has pinned all its hopes on the Bina refinery for its supplies in the completed deregulated scenario. The project was approved by CCEA in December 1995 at an estimated cost of Rs 52.77 billion ($1.10 billion) which has further been escalated to Rs 65.62 billion ($1.37 billion) as on January 2002. The project facilities comprise a single-point mooring, crude oil terminal with connecting sub-sea and onshore pipeline at Vadinar in the Gulf of Kutch, including 935 km cross country crude oil pipeline from Vadinar to Bina, and a 6 MT refinery at Bina for production of all normal fuels and lube base stock.

The project was further delayed due to withdrawal of OOC and then for want of environmental clearances. It has now been decided by the petroleum ministry that BPCL will have 50% equity in the project, Oman Oil Company around 3-4% and the balance will be offered to public, financial institutions and banks. However, because of the current glut in petrol, diesel, naphtha, and ATF, this project is expected to spill over into the eleventh plan period.

Paradeep

IOC is reviewing its 9MMTPA Paradeep refinery project commissioning plans because of time and cost overruns. The project cost has gone up by more than 20% and its implementation has been delayed. Moreover, the delay in project implementation has been because of the withdrawal and subsequent part restoration of incentives by the Orissa government in July 2001. The current sales tax incentives are only around 32.3% of those offered earlier. Also, against the projected demand of 155 MT of petroleum products in the terminal year of the Tenth Five-Year Plan, and 148 MT projected in the Hydrocarbon Vision 2025, currently the demand is expected to grow much lower based on the prevailing trends in the past. All these factors have led IOC to decide to postpone the commissioning of Paradeep refinery.

Vadinar

In view of the delay in the completion of its 10.5 MMTPA refinery project, Essar Oil is in talks with public sector refinery majors, including Indian Oil Corporation and Bharat Petroleum Corporation, for sourcing high speed diesel and petrol for its proposed marketing activities. Work on the refinery project is virtually at a standstill due to paucity of funds. The financial institutions and banks are working on the financial restructuring of the project but the commissioning of this refinery remains uncertain.

Cuddalore

NOCL (Nagarjuna Oil Corporation Ltd) is in talks with oil majors for partnering in its 6 MMTPA refinery project to be set up in Cuddalore in Tamil Nadu. The company is planning to offer the 21% untied equity in the venture so that it could achieve financial closure and draw funds from the financial institutions and banks that have approved term loans. NOCL had submitted a revised offer for equity participation to IOC in July 2001. However no firm arrangement has been made yet. The project has been structured on a debt equity ratio of 2:1. It has been appraised and approved by a consortium of financial institutions led by Industrial Development Bank of India. KfW of Germany has sanctioned the overseas debt.

When completed the NOCL refinery would produce 307 TMT of petrol 3,358 TMT of diesel, 256 TMT of LPG (liquefied petroleum gas), 595 TMT of naphtha, 939 TMT of fuel oil, 73 TMT of bitumen and 27 TMT of sulphur. The company has also applied for marketing rights, for which it is eligible under the latest guidelines as the investment in the project is to be around Rs 34.80 billion ($725.00 million).

Annexures 3.1 and 3.2 provides a statement on the progressive increase in the capacities of the existing refineries to the year 2006/07 for Case 1 and Case 2 respectively. The two scenarios do not take the Punjab refinery project into consideration whose proposed capacity is to be assessed against the supply demand balances in Chapter 4. The individual product yield patterns are applied to each of the refineries to estimate the forward availability of specified products, viz. LPG, naphtha, gasoline, kerosene, ATF, HSD and fuel oil[a]. The region wise refinery capacity as projected is as follows.

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[a] The refinery wise production of various petroleum products for the year 2000-01 is given in Annexure 3.3.

Table 3.4 Yearly region-wise projected refining capacity (MMTPA) -Case 1

Region	2002/03	2003/04	2004/05	2005/06	2006/07	2011/12
Northern	14.00	14.00	14.00	20.00	20.00	20.00
Southern	32.19	32.19	32.19	32.19	35.19	35.19
Eastern	15.80	15.80	15.80	17.95	19.65	19.65
Western	53.43	53.43	53.43	53.43	68.83	68.83
All India	**115.42**	**115.42**	**115.42**	**123.57**	**143.67**	**143.67**

Table 3.5 Yearly region-wise projected refining capacity (MMTPA) -Case 2

Region	2002/03	2003/04	2004/05	2005/06	2006/07	2011/12
Northern	14.00	14.00	14.00	14.00	14.00	14.00
Southern	32.19	32.19	32.19	32.19	35.19	35.19
Eastern	15.80	15.80	15.80	17.95	19.65	19.65
Western	53.43	53.43	53.43	53.43	64.53	64.53
All India	**115.42**	**115.42**	**115.42**	**123.57**	**133.37**	**133.37**

As shown in the above tables, the refinery capacity is projected to remain at the same level in the year 2011/12. This is because of two reasons. Firstly, the refinery capacity additions projected to materialise till 2006/7 will spill over in the eleventh plan period if the economic recovery is less than expected. Secondly, the status of major grassroots refining projects, which will add significant capacity if they materialise, is highly uncertain, as detailed above. No concrete projections can be made regarding their commissioning.

The LPG availability from natural gas has been included in LPG production estimates as more than 45% of the LPG production presently comes from natural gas fractionators at Uran, Hazira and Lakwa and on the Hazira-Bijaipur-Jagdishpur (HBJ) natural gas pipeline of GAIL. Similarly, production of Naphtha and SKO by ONGC at Hazira is also taken into account. The details of projected LPG production from the fractionators are given in Annexure 3.4.

Pipelines feeding into Northern region

An important source of equalising the regional deficit/surplus position is the product pipelines. Presently there are two product pipelines moving petroleum products into the northern region. These are

- Kandla Bhatinda Pipeline (KBPL) with a capacity of 7500 TMT, and
- Barauni Kanpur Pipeline (BKPL) with a capacity of 1800 TMT.

The KBPL transfers the surplus product from western region of the country to the northern region traversing the states of Gujarat, Rajasthan and Uttar Pradesh before terminating in Punjab. The BKPL moves the product from Barauni refinery to eastern parts of Uttar Pradesh.

As noted above, there is a big controversy on converting the KBPL into a crude pipeline, a move that IOC claims will be highly beneficial to the organisation. However, concomitant to the conversion of KBPL into a crude carrier, IOC plans to build two other pipelines. One will start at Panipat and terminate at Rewari and hence is not an inter-regional product pipeline. The other pipeline will start from Koyali and terminate at Sanganer near Jaipur after passing through Sidhpur in Gujarat, with the capacity to move 3400 TMT of petroleum products in a year[a].

These pipelines are integrated into the demand supply scenario built for Case 1 and Case 2 in Chapter 4.

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[a] Petronet has also planned to lay another Kandla Bhatinda pipeline in order to save its Vadinar Kandla pipeline. But this plan is still in its infancy and will take time to get to fruition.

4

Demand supply balances

This chapter brings together the demand and the supply scenarios built in the previous chapters to derive insights about deficit and surplus positions in four regions of the country and to analyse the possible inter-regional flows of petroleum products, especially MS, HSD and SKO, during the study period. It should however be noted that the following analysis does not take into account the relative cost effectiveness of various sources in supplying to this region. This issue is tackled in later chapters.

Regional surplus/deficit position

The following tables show the deficit/surplus positions[a] in the four regions for all seven petroleum products considered in the study for the year 2006/7 and 2011/12 for both cases[b].

Table 4.1 Product wise regional deficit/surplus position in 2006/7 for Case 1 (TMT)

	Northern	Eastern	Western	Southern	Total
LPG	-3264	-735	2314	-2170	-3856
NAPHTHA	509	-93	849	1055	2322
MS	-1177	233	2827	315	2198
HSD	-11320	926	10039	-2045	-2400
ATF	-241	210	1483	144	1595
FO/LSHS	-1489	288	-465	847	-819
SKO	-757	-763	3421	1055	2956

Table 4.2 Product wise regional deficit/surplus position in 2011/12 for Case 1 (TMT)

	Northern	Eastern	Western	Southern	Total
LPG	-4211	-990	1189	-2991	-7003
NAPHTHA	485	-580	-880	525	-450
MS	-2621	-171	1648	-832	-1976
HSD	-18441	-1721	4864	-7580	-22879
ATF	-489	151	1272	28	962
FO/LSHS	-2628	-149	-2741	-732	-6251
SKO	-691	-706	3494	1108	3205

---

[a] Refinery-wise production of these seven petroleum products for the years 2006/07 and 2011/12 for both cases is shown in Annexure 4.1

[b] Case 1 assumes the conversion of KBPL into a crude carrier and Case 2 assumes otherwise.

Table 4.3 Product wise regional deficit/surplus position in 2006/7 for Case 2 (TMT)

	Northern	Eastern	Western	Southern	Total
LPG	-3414	-735	2207	-2170	-4112
NAPHTHA	361	-93	441	1055	1765
MS	-1864	233	2514	315	1197
HSD	-13853	926	8577	-2045	-6395
ATF	-469	210	1320	144	1204
FO/LSHS	-1941	288	-1186	847	-1992
SKO	-1337	-763	3014	1055	1969

Table 4.4 Product wise regional deficit/surplus position in 2011/12 for Case 2 (TMT)

	Northern	Eastern	Western	Southern	Total
LPG	-4361	-990	1082	-2991	-7259
NAPHTHA	337	-580	-1289	525	-1007
MS	-3309	-171	1335	-832	-2977
HSD	-20974	-1721	3402	-7580	-26873
ATF	-717	151	1109	28	571
FO/LSHS	-3080	-149	-3463	-732	-7424
SKO	-1271	-706	3087	1108	2219

These tables underlie the broad trend expected in inter regional flows of petroleum products. The northern region will remain in deficit for all the products except naphtha while western region is expected to be in surplus in almost all the products. Thus, products will move from the western region to the northern region[a]. The specific issue of the nature of this movement is dealt with in Chapter 5.

The following table shows the region wise surplus/deficit positions in three products – MS, HSD and SKO, both for Case 1 and Case 2[b].

Table 4.5 Region wise deficit/surplus position in Case 1 (TMT)

Year	Northern	Eastern	Western	Southern	Total
2002/3	-12112	21	11385	1864	1159
2003/4	-13219	-364	10560	1000	-2023
2004/5	-14407	-779	9667	74	-5445
2005/6	-11885	196	8723	-923	-3890
2006/7	-13254	395	16287	-675	2753
2007/8	-14723	-120	15201	-1821	-1463
2008/9	-16298	-674	14037	-3050	-5986
2009/10	-17989	-1269	12788	-4368	-10838
2010/11	-19807	-1910	11444	-5786	-16059
2011/12	-21754	-2597	10005	-7304	-21649

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[a] This pattern corresponds to the latest available refinery yields and accordingly could change given the degree of flexibility of each refinery to switch between products.

[b] Case 1 corresponds to assumption of conversion of KBPL into crude carrier by 2005/6 while Case 2 assumes otherwise.

Table 4.6 Region wise deficit/surplus position in Case 2 (TMT)

TMT	Northern	Eastern	Western	Southern	Total
2002/3	-12112	21	11385	1864	1159
2003/4	-13219	-364	10560	1000	-2023
2004/5	-14407	-779	9667	74	-5445
2005/6	-15685	196	8723	-923	-7690
2006/7	-17054	395	14105	-675	-3229
2007/8	-18523	-120	13020	-1821	-7445
2008/9	-20099	-674	11855	-3050	-11968
2009/10	-21789	-1269	10606	-4368	-16820
2010/11	-23607	-1910	9262	-5786	-22041
2011/12	-25554	-2597	7824	-7304	-27631

The deficit/surplus position indicated here, however, obscures the more relevant picture for HPCL whose supply region is constrained by infrastructure. This issue is discussed below.

Analysis of demand in the northern region

The northern region, as taken in this study, comprises of the states of Jammu & Kashmir, Himachal Pradesh, Haryana, Punjab, Delhi, Uttar Pradesh[a], Rajasthan and the union territory of Chandigarh. Figure 4.1 shows the map of the region along with the western region and the oil depots in the regions.

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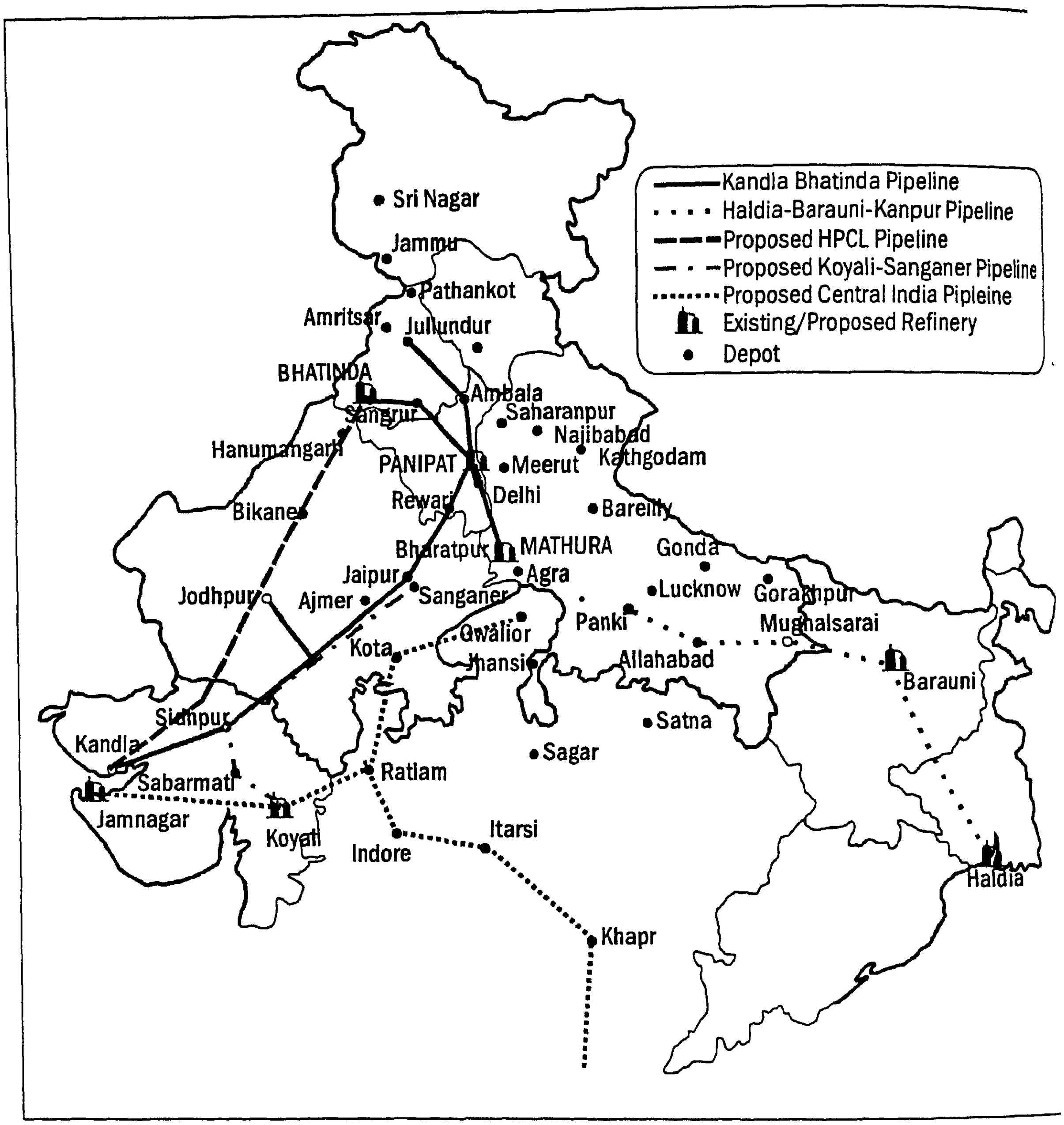
[a] The state of Uttar Pradesh has been now been bifurcated into two states of Uttranchal and Uttar Pradesh. However, this aspect does not affect our analysis.

Figure 4.1 Map of Northern Region



This figure shows various pipelines and refineries feeding into the northern region along with the proposed HPCL pipeline from Mundra to Bhatinda and the proposed HPCL refinery at Bhatinda. It is clear from the figure that the area of interest to HPCL Bhatinda is the western part of north India comprising of entire states of Jammu & Kashmir, Himachal Pradesh, Haryana, Punjab, Delhi and union territory of Chandigarh and parts of Uttar Pradesh and Rajasthan because of the presence of other modes of supply feeding to the excluded parts of the northern region. The KBPL, the proposed Koyali-Sanganer pipeline and the Central India pipeline (CIPL) are such other sources of supply. Since KBPL is terminating at Bhatinda, it is a potential source of supply to the region identified as the area of interest to HPCL apart from supplying to the southern Rajasthan and parts of Gujarat. And so are the two refineries – Panipat and Mathura. This so-called "designated area" is most relevant to HPCL because the parts excluded from this designated area are in no position to be served economically by either the proposed HPCL Bhatinda refinery or the pipeline. The pipeline, though traversing the state of Rajasthan, does not have any tap-off point from where it can supply to districts of Rajasthan. The refinery at Bhatinda is situated too far to cater to demand originating from eastern UP or southern Rajasthan. And once the Central India pipeline comes through, it will cater to the demand of eastern UP, in addition to that of Madhya Pradesh.

This demand analysis is therefore taken to the level of oil depots in the region. The reason for choosing depots and not districts emanate from the fact that most of the demand of any district is met through these depots only and taking the analysis to the district will add unnecessary complexity.

Then, the depots situated in the area of interest to HPCL along with the associated states are as follows:

Table 4.7 Depots considered in the northern region

Depot	State	Depot	State
Sri Nagar	Jammu & Kashmir	Kathgodam	Uttar Pradesh
Jammu	Jammu & Kashmir	Meerut	Uttar Pradesh
Pathankot	Punjab	Saharanpur	Uttar Pradesh
Amritsar	Punjab	Najibabad	Uttar Pradesh
Jullunder	Punjab	Agra	Uttar Pradesh
Bathinda	Punjab	Bareilly	Uttar Pradesh
Sangrur	Punjab	Shahjahanpur	Uttar Pradesh
Ambala	Haryana	Bharatpur	Rajasthan
Hisar	Haryana	Bikaner	Rajasthan
Rewari	Haryana	Hanumangarh	Rajasthan
Panipat	Haryana	Parwanoo	Himachal Pradesh
Chandigarh	-	Delhi	-

The total demand for MS, HSD and SKO originating from these depots[a] for the study period is as follows.

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[a] The depot wise demand is given in Annexure 4.2.

Table 4.8 Demand for MS, HSD and SKO (TMT)

Year	Demand
2002/3	13052
2003/4	13781
2004/5	14563
2005/6	15405
2006/7	16305
2007/8	17270
2008/9	18304
2009/10	19413
2010/11	20606
2011/12	21881

Thus, the demand quantum relevant to HPCL is the demand originating from the depots in the "designated areas".

Analysis of supply sources

As mentioned above, the supply scenario has been dealt with in two cases – one assuming the conversion of KBPL into a crude carrier for Panipat refinery expansion and the other case assuming otherwise. Both these cases are discussed below.

Case 1 - Kandla Panipat pipeline converted into a crude pipeline

Under this scenario, there are five possible sources that can meet the demand in designated depots of north India. These are-

- Supply from Mathura Refinery
- Supply from Panipat Refinery
- KBPL till its conversion into crude carrier in 2005/6
- Supply from Panipat Refinery Expansion after its commissioning in 2005/6.
- Supply from HPCL Pipeline/Refinery after its commissioning in 2006/7.

The reason for differentiating between existing Panipat refinery and Panipat refinery expansion is the difference in the cost of crude transportation for these refineries that will raise the delivered prices of HSD, priced at import parity price at various depots.

The supply of MS, HSD and SKO, from the existing refineries of Panipat and Mathura and the proposed Panipat refinery expansion is as follows:

Table 4.9 Supply from existing and proposed refineries in the northern region (TMT)

Year	Mathura	Panipat Existing	Panipat Expansion	Total
2002/3	4484	3800	-	8284
2003/4	4484	3800	-	8281
2004/5	4484	3800	-	8284
2005/06	4484	3800	3800	12084
2006/07	4484	3800	3800	12084
2007/08	4484	3800	3800	12084
2008/09	4484	3800	3800	12084
2009/10	4484	3800	3800	12084
2010/11	4484	3800	3800	12084
2011/12	4484	3800	3800	12084

Another source of supply till the year 2004/5, as mentioned above, is the KBPL. The capacity of KBPL is 7500 TMT but the quantity of products supplied in the designated region depends on the demand originating from the depots that fall on the route of KBPL[a]. These depots are Sidhpur, Udaipur, Jodhpur, Kota, Ajmer and Jaipur. The demand in these depots and the residual quantity that can be carried by KBPL[b] to the rest of the northern region towards its termination point is as follows:

Table 4.10 Potential supply by KBPL (TMT)

Depots	2001/2	2002/3	2003/4	2004/5
Ajmer	297	364	385	407
Jaipur	798	964	1018	1075
Jodhpur	714	875	922	974
Kota	378	457	482	507
Udaipur	436	532	561	591
Sidhpur	382	456	478	502
Total	2623	3192	3367	3554
KBPL	7500	7500	7500	7500
Residual in KBPL	4877	4308	4133	3946

Thus, the demand that can be met by KBPL falls from 4.8 MMTPA in 2001/2 to 3.9 MMTPA in 2004/5, which means that additional product movement or an additional source of supply will be required in the northern region.

Bringing together all the possible supply sources, excluding HPCL Pipeline/Refinery in this region gives the total supply of MS, HSD and SKO in this region as follows:

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[a] Refer to figure 4.1.

[b] KBPL is used primarily to supply the products from Reliance's Jamnagar refinery to North India.

Table 4.11 Total supply in the region (TMT)

Year	Supply
2002/3	12592
2003/4	12417
2004/5	12230
2005/06	12084
2006/07	12084
2007/08	12084
2008/09	12084
2009/10	12084
2010/11	12084
2011/12	12084

The resultant demand supply position in this region thus is as follows:

Table 4.12 Resultant demand supply position (TMT)

Year	Demand	Supply	Deficit/Surplus
2002/3	13052	12592	-460
2003/4	13781	12417	-1364
2004/5	14563	12230	-2333
2005/06	15405	12084	-3321
2006/07	16305	12084	-4221
2007/08	17270	12084	-5186
2008/09	18304	12084	-6220
2009/10	19413	12084	-7329
2010/11	20606	12084	-8522
2011/12	21881	12084	-9797

The deficit shown in the above table shows the minimum demand for MS, HSD and SKO that will be available to HPCL. As against the production of 6750 TMT of these three products, this scenario gives more than 100 % refinery capacity utilisation in the year 2009/10. However, if the pipeline of 9 MMTPA capacity is installed in the year 2005/6, as the plans are, the pipeline capacity utilisation will be 37.5% and will rise to 100% only in the year 2011/12. It should however be noted that this analysis does not consider the cost effectiveness of different supply sources vis-à-vis each other. This analysis is carried out in chapter 5.

Case 2 - Kandla Panipat Pipeline Not Converted into a crude carrier

Under this scenario, there are four possible sources of supply of MS, HSD and SKO to the northern region. These are –

- Supply from Mathura Refinery
- Supply from Panipat Refinery
- KBPL
- Supply from HPCL Pipeline/Refinery

The supply from existing refineries of Panipat and Mathura is shown in table 4.8.

As it is assumed that KBPL will not be converted into crude carrier, the potential quantity supplied by KBPL till the year 2011/12, based on reasoning given above will be as follows:

Table 4.13 Potential supply by KBPL (TMT)

Year	Ajmer	Jaipur	Jodhpur	Kota	Udaipur	Sidhpur	Total	KBPL Capacity	Residual in KBPL
2002/3	364	964	875	457	532	456	3192	7500	4308
2003/4	385	1018	922	482	561	478	3367	7500	4133
2004/5	407	1075	974	507	591	502	3554	7500	3946
2005/6	431	1137	1029	535	624	528	3756	7500	3744
2006/7	456	1203	1088	565	660	556	3972	7500	3528
2007/8	484	1274	1151	597	698	586	4205	7500	3295
2008/9	513	1351	1219	632	739	618	4454	7500	3046
2009/10	545	1432	1293	669	783	652	4722	7500	2778
2010/11	579	1520	1372	709	831	690	5010	7500	2490
2011/12	615	1615	1456	752	882	729	5320	7500	2180

Bringing together all the supply sources in the region, excluding the HPCL Pipeline/Refinery, yields the following supply picture.

Table 4.14 Total potential supply in the northern region (TMT)

Year	Mathura	Panipat Existing	KBPL	Total
2002/3	4484	3800	4308	12592
2003/4	4484	3800	4133	12417
2004/5	4484	3800	3946	12230
2005/06	4484	3800	3744	12028
2006/07	4484	3800	3528	11812
2007/08	4484	3800	3295	11579
2008/09	4484	3800	3046	11330
2009/10	4484	3800	2778	11062
2010/11	4484	3800	2490	10774
2011/12	4484	3800	2180	10464

The resultant demand supply position in this region is as follows:

Table 4.15 Resultant demand supply position (TMT)

Year	Demand	Supply	Deficit/Surplus
2002/3	13052	12592	-460
2003/4	13781	12417	-1364
2004/5	14563	12230	-2333
2005/06	15405	12028	-3377
2006/07	16305	11812	-4493
2007/08	17270	11579	-5691
2008/09	18304	11330	-6974
2009/10	19413	11062	-8351
2010/11	20606	10774	-9832
2011/12	21881	10464	-11417

Under this scenario then, given the production of 6750 TMT of MS, HSD and SKO from HPCL Bhatinda refinery, the refinery can have 100% capacity utilisation by the year 2008/9. However, if the pipeline is installed in the year 2005/6, as the plans are, the capacity utilisation of the pipeline will come out as 37.5%, given the capacity of 9000 TMTPA. The capacity utilisation of the pipeline will rise to 100% in the year 2010/11.

This table however shows the demand that is available to new supply source in the region. How much demand can HPCL actually meet depends on the cost effectiveness of various supply sources. This aspect is covered in detail in chapter 5.

It can be seen that not much change has happened in the demand available to HPCL between the two cases considered. This is because of the fact that most of the reduction in supply due to non-availability of KBPL is being made up by IOC by expanding its' Panipat refinery capacity. However, the main difference that this conversion is expected to make is in the terms of cost effectiveness of each option in supplying to the depots in the region. This issue is dealt in detail in the next chapter.

5

Detailed market analysis

The previous chapter brought out the demand in MS, HSD and SKO that the HPCL can cater to. This demand was estimated as a residual quantity that is left after the existing sources of supply have met demand to their maximum potential. In a deregulated scenario, however, this cannot be assumed. The market share of each supply source will depend, inter alia, upon the delivered cost of product at various demand centres to identify the source that can supply at the lowest price. This source will meet the demand first followed by the second best supplier and so on. This chapter then seeks to analyse the market share that HPCL can garner based on a transportation model.

The approach

The main objective of the model is to identify the source of supply for each depot in the "designated area" under both cases. After determining the delivered cost of HSD at each depot from each possible source, the model determines the least cost option for each depot, subject to the constraint that each demand centre has to be fed. To deal with cases where the supply from potential sources of supply in the northern region is inadequate to meet the entire demand, a dummy supply source has been included with high costs of supply to the depot so that it does not interfere with the normal working of the model. The depots which are being supplied by dummy supply source probably indicate the centres where no supply source is willing to meet the demand.

Such a situation was not thought of in the APM era because the government ensured that each depot was fed the requisite quantity irrespective of economics of the process since the marketing companies were being compensated by the government. In the post APM era, however, the apprehension is that the proposed oil and gas regulator may not permit this to happen and may require by stricture that all demand centres be taken care of by the marketing companies. However, there is an ambiguity in how this order will be implemented. Whether the regulator, in such cases, allow the oil companies to collude to enter into hospitality arrangements which makes swapping of products possible or whether the government will itself compensate the marketing company supplying to the so called "uneconomic demand centre" remains to be seen.

It is also difficult to factor in such regulatory interventions in the economic model that works on the principle of least cost. Hence, this model does not assume any such constraints whereby no demand centre should be left dry but brings out the most economical depots that will be served by each supply source, given the favourable freight economics and depreciated assets.

Assumptions of the model

The pricing of the petroleum products have been freed by the government as it dismantled the Administered Pricing Mechanism (APM) this year. However, for the purpose of this analysis, it has been assumed that import parity pricing principle will be followed by the oil companies in pricing their products at various locations, thus reaping any advantage that may accrue to them by the virtue of distance to the market compared to other competitors. This assumption then, does not concur on any refinery any advantage arising due to lower processing costs or like. Any such advantage will only result in higher margins for the refinery and is not likely to affect a deficit region.

The landed cost of HSD at Kandla has been taken as the starting point that is same for all supply sources irrespective of its location and nature. This landed price refers to the Ex-AG fob of HSD as reported by Petroleum Argus in its Global Markets for the week of 29th July to 1st August. The detailed build up of the landed price at Kandla is as follows.

Table 5.1 Landed price of HSD at Kandla

Element	Unit	Factors	HSD
Fob (ex-AG)	**$/MT**		**197***
Fob	**Rs/MT**	**48.96**	**9639**
Load Port Charges	Rs/MT	1	49
Freight (LR II)	**$/MT**	2.50	8.4
Freight	Rs/MT		412
Fob + freight	**Rs/MT**		**10100**
Insurance	Rs/MT	0.3%	30
Ocean Loss	Rs/MT	0.3%	30
Cif	**Rs/MT**		**10161**
Landing charges	Rs/MT		60
CIF + Landing charges	Rs/MT		10221
LC Charges	Rs/MT	0.3%	30
Basic Customs duty	Rs/MT		2044
Cost inluding duty	**Rs/MT**		**12235**
PORT CHARGES			
Port dues	Rs/MT		7.83
Pilotage	Rs/MT		14.69

Element	Unit	Factors	HSD
Birth Hire	Rs/MT		1.96
Mooring Charges	Rs/MT		0.59
Stream Dues	Rs/MT		0.02
Wharfage	Rs/MT		35
Landed cost	Rs/MT		12295
Terminalling charges	Rs/MT		182
Landed price	Rs/MT		12477

* Based on 29 July – 1 August issue of Petroleum Argus

After the product has landed at Kandla, it has to be moved to the respective refinery location. The traditional definition of import parity adds the freight charges of moving the product from that port location to the refinery gate. However, what actually moves in reality is the crude and not the product and hence in this analysis, the cost of moving crude from Kandla to refineries considered has been added to arrive at the import parity at the refinery gate. The cost of moving crude to the respective refinery locations is derived as follows.

For Mathura refinery

The Salaya-Mathura pipeline (SMPL) is the only carrier of crude for this refinery. The indicative tariff for this pipeline, as given in the Third Report of Expert Technical Group (ETG) are Rs 108.97/MT. Escalating this for two years using 80% of the average inflation of 6% gives the operating costs for this pipeline for the year 2001/2 as Rs 119.68/MT.

For Panipat refinery

The existing Panipat refinery, without the expansion, is also dependent on the SMPL which branches off at Chaksu and moves to Panipat. The indicative tariff for this pipeline, as per the Third Report of ETG and escalated for two years using 80% of the average inflation of 6%, is Rs 476.62/MT.

For Panipat refinery (Expansion)

As mentioned in the previous chapters, two scenarios are built for supply sources based on the fate of IOC's decision to convert the KBPL into a crude carrier. If this goes through, then Panipat refinery (Expansion) will be fed crude through this line. However, some additional costs have to be incurred in order to use this pipeline for transporting crude. This will involve additional facilities at the jetty in Mundra and creation of Mundra - Kandla link. Estimates suggests that these works will cost Rs 179/MT. Apart from that, a financial model has been constructed to estimate the operating costs of the KBPL, taking into account the depreciation and other expenditures. The indicative tariff, as estimated by this model, comes to Rs 662/MT. The details are given in Annexure 5.1.

Overall, the cost of transporting crude through the KBPL till Panipat comes to Rs 841/MT.

For Bhatinda refinery

HPCL is planning to lay a pipeline from Mundra to Bhatinda for supplying crude to the proposed 9 MMTPA Bhatinda refinery. The capital cost of this pipeline is Rs 2353 crores. A financial model is constructed which estimates the yearly operating costs of this pipeline and estimates the levelised tariff for this pipeline as Rs 941/MT. The details of the financial model are given in Annexure 5.2.

Import parity prices at refinery gate

Adding the above mentioned crude transportation costs to the landed cost of HSD at Kandla gives the following import parity prices at the refinery gate.

Table 5.2 Import parity prices at various refineries

Refinery	Unit	Value
Mathura	Rs/MT	12596
Panipat	Rs/MT	12953
Panipat Expansion	Rs/MT	13318
Bhatinda	Rs/MT	13420

Freights charges from refinery to depot

Added to the above given import parity prices at the refinery gate are the freight charges of moving HSD from refinery to the depots in the designated area. These charges are calculated according to the mode of transportation that will be used to move the product from refinery to that particular depot. It can be via pipeline, or via railways or via road or by a combination of these three.

Depot wise landed prices of HSD from various supply sources is given in Annexure 5.3 and Annexure 5.4 corresponding to Case 1 and Case 2 detailed above.

The transportation model

The transportation model deals with the situation in which a commodity is shipped from various sources to destinations. In this case, the sources are the supply sources, either the refineries or the pipelines and the destinations are the depots considered in the analysis. The objective of the model is to determine the amount shipped from each source to each destination that minimises the total shipping costs while satisfying both the supply limits and demand requirements.

The supply sources in this model depend on the two supply cases detailed in the previous chapters. In Case 1, it is assumed that Kandla Panipat section of KBPL is converted into a crude carrier and hence KBPL as a supply source to the northern region is replaced by Panipat refinery expansion. On the other hand, in Case 2 it is assumed that KBPL will remain a product pipeline and Panipat refinery expansion will not materialise because of which KBPL is retained as the source for supply to the northern region.

In addition to these supply sources, a dummy supply source, with exceptionally high delivered cost at each depot has been added which helps to identify the unmet demand in the region and the depots which will be left unserved by the present supply sources.

The results for the transportation model for both the supply scenarios are given below.

Case 1 - Kandla Panipat pipeline is converted into a crude carrier

The following tables show the depot wise supply source for supply scenario Case 1 for the years 2006/7 and 2011/12[a].

Table 5.3 Depots likely to be served by Bhatinda refinery in 2006/7 under Case 1 (TMT)

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda	Dummy
SriNagar	0	0	0	303	0
Jammu	0	0	0	233	0
Pathankot	0	0	0	273	0
Amritsar	0	0	0	369	0
Jullunder	0	330	1192	0	0
Parwanoo	0	0	472	0	0
Chandigarh	0	226	0	0	0
Bathinda	0	0	0	1038	0
Sangrur	0	1156	0	0	0
Hanumangarh	0	0	0	237	0
Bikaner	0	0	0	245	0
Ambala	0	507	0	0	0
Hisar	0	0	660	0	0
Rewari	0	0	1188	0	0
Kathgodam	0	0	0	287	0
Meerut	0	1120	0	0	0
Saharanpur	0	0	289	186	0
Najibabad	0	0	0	168	0
Delhi	2824	0	0	0	0
Bharatpur	183	0	0	0	0
Agra	943	0	0	0	0
Bareilly	0	0	0	768	0
Shahjahanpur	0	0	0	113	0

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[a] The results of the model for the period 2007/8 – 2010/11 are given in Annexure 5.5.

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda	Dummy
Panipat	535	462	0	0	0
Total Demand	4484	3800	3800	4220	0
Total Supply	4484	3800	3800	6750	10000
Capacity Utilisation	100%	100%	100%	63%	0%

The shaded cells represent the dummy variable.

Table 5.4 Depots likely to be served by Bhatinda refinery by 2011/12 in Case 1 (TMT)

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda	Dummy
SriNagar	0	0	0	0	380
Jammu	0	0	0	17	288
Pathankot	0	0	0	365	0
Amritsar	0	0	0	495	0
Jullunder	0	0	1357	698	0
Parwanoo	0	0	0	631	0
Chandigarh	0	0	311	0	0
Bathinda	0	0	0	1401	0
Sangrur	0	0	1557	0	0
Hanumangarh	0	0	0	315	0
Bikaner	0	0	0	325	0
Ambala	0	685	0	0	0
Hisar	0	0	0	891	0
Rewari	0	0	0	1614	0
Kathgodam	0	0	0	0	380
Meerut	0	1492	0	0	0
Saharanpur	0	0	0	0	624
Najibabad	0	0	0	0	219
Delhi	2993	276	576	0	0
Bharatpur	242	0	0	0	0
Agra	1249	0	0	0	0
Bareilly	0	0	0	0	1005
Shahjahanpur	0	0	0	0	151
Panipat	0	1347	0	0	0
Total Demand	4484	3800	3800	6750	3046
Total Supply	4484	3800	3800	6750	10000
Capacity Utilisation	100%	100%	100%	100%	30%

The shaded cells represent the dummy variable.

These tables show that in the year 2006/7, the year in which the refinery is targeted to be commissioned, HPCL will be able to corner 25% of the share of demand in the "designated area" of the total demand of 16304 TMT for MS, HSD and SKO. Consequently, the refinery will run at 63% capacity utilisation given the production of 6750 TMT of MS, HSD and SKO from the refinery.

However, as the demand will rise in the region, the HPCL will be able to sell increasing quantity of MS, HSD and SKO, reaching 100% capacity utilisation in the year 2009/10.

There will be a deficit of around 3046 TMT, as shown by demand being met by the dummy supply source, in the year 2011/12 in the "designated area" which will probably be met by other sources like railway movement from the western region or from the increased production of these products either by changing the yield pattern of the refinery to produce more of MS, HSD and SKO or by running the refineries at higher than 95% capacity utilisation.

These tables also show that some depots in far to reach areas like Shahjahanpur, Saharanpur, Najibabad and Kathgodam etc. will be not probably served by any of the supply source. This is because the potential supply from supply sources considered will be exhausted before serving these areas.

On the other hand, if HPCL intends to use the crude pipeline of capacity 9 MMTPA for moving products to this region, it would not get 100% capacity utilisation till the year 2011/12.

Case 2 – Kandla Panipat pipeline is not converted into a crude carrier

The following tables show the depot wise supply source for supply scenario Case 2 for the years 2006/7 and 2011/12[b].

Table 5.5 Depots likely to be served by Bhatinda refinery in 2006/7 in Case 2 (TMT)

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda	Dummy
SriNagar	0	0	0	303	0
Jammu	0	0	0	233	0
Pathankot	0	0	0	273	0
Amritsar	0	0	0	369	0
Jullunder	0	330	1192	0	0
Parwanoo	0	0	244	228	0
Chandigarh	0	226	0	0	0
Bathinda	0	0	0	1038	0
Sangrur	0	1156	0	0	0
Hanumangarh	0	0	0	237	0
Bikaner	0	0	245	0	0
Ambala	0	507	0	0	0
Hisar	0	0	660	0	0
Rewari	0	0	1188	0	0
Kathgodam	0	0	0	287	0
Meerut	0	1120	0	0	0
Saharanpur	0	0	0	475	0
Najibabad	0	0	0	168	0
Delhi	2824	0	0	0	0
Bharatpur	183	0	0	0	0

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[b] The results of the model for the period 2007/8 – 2010/11 are given in Annexure 5.6.

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda	Dummy
Agra	943	0	0	0	0
Bareilly	0	0	0	768	0
Shahjahanpur	0	0	0	113	0
Panipat	535	462	0	0	0
Total Demand	4484	3800	3528	4492	0
Total Supply	4484	3800	3528	6750	10000
Capacity Utilisation	100%	100%	100%	67%	0%

The shaded cells represent the dummy variable.

Table 5.6 Depots likely to be served by Bhatinda refinery in 2011/12 in Case 2 (TMT)

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda	Dummy
SriNagar	0	0	0	0	380
Jammu	0	0	0	0	305
Pathankot	0	0	0	0	365
Amritsar	0	0	0	495	0
Jullunder	0	0	0	2054	0
Parwanoo	0	0	0	0	631
Chandigarh	0	0	0	311	0
Bathinda	0	0	0	1401	0
Sangrur	0	0	0	1557	0
Hanumangarh	0	0	0	315	0
Bikaner	0	0	0	0	325
Ambala	0	685	0	0	0
Hisar	0	0	0	608	283
Rewari	0	0	1614	0	0
Kathgodam	0	0	0	0	380
Meerut	0	1492	0	0	0
Saharanpur	0	0	0	0	624
Najibabad	0	0	0	0	219
Delhi	2993	276	566	10	0
Bharatpur	242	0	0	0	0
Agra	1249	0	0	0	0
Bareilly	0	0	0	0	1005
Shahjahanpur	0	0	0	0	151
Panipat	0	1347	0	0	0
Total Supply	4484	3800	2180	6750	4666
Total Demand	4484	3800	2180	6750	10000
Capacity Utilisation	100%	100%	100%	100%	47%

The shaded cells represent the dummy variable.

This table shows that if Kandla Panipat pipeline is not converted into a cr pipeline, Bhatinda refinery will have more demand to cater to since KBPL will be constrained by the quantity it will be able to deliver in this region. The Bhatinda refinery will be able to sell 4492 TMT of MS, HSD and SKO in the "designated area", thus having a market share of 27.5% and having capacity utilisation of 67%.

The refinery will be able to operate at 100% capacity utilisation in the year 2008/9 and will have a market share of 30.85% in the year 2011/12. As is apparent, this increase is due to increasing demand for these products in the region as well as dwindling surplus of KBPL due to increasing demand in the on route areas in Gujarat and Rajasthan.

By the year 2011/12, if Kandla Bhatinda pipeline is not converted into a crude carrier, there will be a deficit of 4666 TMT of MS, HSD and SKO. This will be met either by increased production from refineries in this region, made possible either by change in yields or by increased capacity utilisation, or by inter regional transfer by rail since KBPL has already been considered in the analysis.

On the other hand, if HPCL decides to use the proposed crude pipeline as a product carrier to serve the designated region, it would not get 100% capacity utilisation on this pipeline till the year 2011/12, given the pipeline capacity of 9 MMTPA.

6

Conclusions

- The all-India demand for MS, HSD, SKO, LPG, Naphtha, FO/LSHS and ATF for the terminal years of tenth plan and eleventh plan is expected to be 115.878 MMT and 151.817 MMT respectively.
- Western region leads in the demand for these seven products with a 32.3% share in 2006/7 closely followed by northern region with 29.31%. The share of western region is expected to come down to 32.01% in the year 2011/12 while that of northern region is expected to rise marginally to 29.52%.
- **Out of these seven products, MS, HSD and SKO lead the pack with 64% (75100 TMT) of total demand in the year 2006/7, which rises marginally to 65% (99604 TMT) in 2011/12.**
- Since IOC's decision to convert the Kandla Panipat section of Kandla-Bhatinda pipeline into a crude carrier is hanging final word, two supply scenarios have been built into the analysis with opposite assumptions about this conversion.
- Case 1 refers to the situation whereby the Kandla – Panipat section of the Kandla – Bhatinda pipeline is converted into a crude carrier and subsequently the Panipat refinery's expansion of 6 MMTPA and Koyali refinery's expansion of 4.3 MMTPA materialises. Case 2 refers to scenario whereby the status quo for the pipeline is maintained and hence the two above mentioned expansions do not come through during the study period.
- Other major expansions expected to materialise during the study period are-
  - Reliance's Jamnagar refinery expansion to 33 MMTPA
  - HPCL Mumbai refinery's expansion of 0.33 MMTPA
  - BPCL Mumbai's expansion by 5.1 MMTPA
  - IOC Barauni's expansion by 1.8 MMTPA
  - IOC Haldia's expansion by 1.4 MMTPA
  - CPCL Madras expansion by 3 MMTPA
  - CBU expansion by 0.5 MMTPA, and
  - BRPL expansion by 0.650 MMTPA.
- Consequent to these expansions, **the refinery capacity is expected to rise to 143.67 MMTPA by the year 2011/12 in Case 1 and 133.37 MMTPA by the year 2011/12 in Case 2.**

- In addition to the refining capacity, product pipelines, moving the surplus of primarily western region to the deficit northern region, represent another important source of supply for the northern region. There are at present two product pipelines serving the northern region – Kandla - Bhatinda pipeline (KBPL) and the Barauni – Kanpur pipeline (BKPL). IOC is planning to lay two pipelines to replace the KBPL as and when it is converted into a crude carrier. One pipeline will start from Koyali and will move products to Rajasthan till Sanganer while another one will carry products from Panipat to Rewari.
- Juxtaposing the demand for MS, HSD and SKO and supply from refineries, the following demand supply scenario emerges.

Table 6.1 Region wise deficit/surplus position in Case 1 (TMT)

Year	Northern	Eastern	Western	Southern	Total
2006/7	-13254	395	16287	-675	2753
2011/12	-21754	-2597	10005	-7304	-21649

Table 6.2 Region wise deficit/surplus position in Case 2 (TMT)

TMT	Northern	Eastern	Western	Southern	Total
2006/7	-17054	395	14105	-675	-3229
2011/12	-25554	-2597	7824	-7304	-27631

- However, the whole of northern region cannot be supplied by the Bhatinda refinery in the presence of nearer refineries or pipelines moving the products from one region to another. Thus, the demand relevant to the Bhatinda refinery is expected to come from the North-West India comprising of entire states of Jammu & Kashmir, Himachal Pradesh, Haryana, Punjab, Delhi, part of Rajasthan and Uttar Pradesh and union territory of Chandigarh (shown in figure 4.1).
- **The total demand for MS, HSD and SKO, originating from this region is 16.305 MMT in 2006/7 and 21.881 MMT in 2011/12.**
- Bringing together the supply from all sources (refineries and inter-regional pipelines) and the demand in this area yields the following deficit/surplus position.

Table6.3 Resultant demand supply position in Case 1 (TMT)

	Demand	Supply	Deficit/Surplus
2006/07	16305	12084	-4221
2011/12	21881	12084	-9797

Table 6.4 Resultant demand supply position in Case 2 (TMT)

	Demand	Supply	Deficit/Surplus
2006/07	16305	11812	-4493
2011/12	21881	10464	-11417

- **Thus, at the minimum, the deficit shown in the designated region is the demand for MS, HSD and SKO that HPCL can cater to either through pipeline or through the refinery.**
- In order to identify the exact market share that the HPCL refinery/pipeline will be able to cater to, a transportation model is constructed that allocates depots in the region according to least cost supplier basis.
- For this model, the base price used for all sources was the import parity prices of HSD at Kandla.
- The costs of transporting crude from port to respective refinery locations was added to arrive at the import parity price of HSD at each refinery capable of supplying products to the area under study.
- The model results for Case 1 show that in the year 2006/7, the year in which the refinery is targeted to be commissioned, HPCL will be able to corner 25% of the share of demand in the "designated area" of the total demand of 16304 TMT for MS, HSD and SKO. Consequently, the refinery will run at 63% capacity utilisation given the production of 6750 TMT of MS, HSD and SKO from the refinery. However, **as the demand will rise in the region, the HPCL will be able to sell increasing quantity of MS, HSD and SKO, reaching 100% capacity utilisation in the year 2009/10.**
- On the other hand, **if HPCL intends to use the crude pipeline of capacity 9 MMTPA for moving products to this region, it would not get 100% capacity utilisation till the year 2011/12.**
- The model results for Case 2 show that if Kandla Panipat pipeline is not converted into a crude pipeline, Bhatinda refinery will have more demand to cater to since KBPL will be constrained by the quantity it will be able to deliver to this region. The Bhatinda refinery will be able to sell 4492 TMT of MS, HSD and SKO in the "designated area", thus having a market share of 27.5% and having capacity utilisation of 67%. **The refinery will be able to operate at 100% capacity utilisation in the year 2008/9 and will have a market share of 30.85% in the year 2011/12.**
- On the other hand, **if HPCL decides to use the proposed crude pipeline as a product carrier to serve the designated region, it would not get 100% capacity utilisation on this pipeline till the year 2011/12, given the pipeline capacity of 9 MMTPA.**

Annexure 3.1

Expected refining cpacity (MMTPA) CASE 1

Refinery	2002/03	2003/04	2004/05	2005/06	2006/07
Northern Region					
IOC, Panipat	6.00	6.00	6.00	12.00	12.00
IOC, Mathura	8.00	8.00	8.00	8.00	8.00
Sub total	14.00	14.00	14.00	20.00	20.00
Southern Region					
MRL, Madras	6.00	6.00	6.00	6.00	9.00
CRL, Cochin	7.50	7.50	7.50	7.50	7.50
MRL , Narimanam	1.50	1.50	1.50	1.50	1.50
HPCL, Vishakh	7.50	7.50	7.50	7.50	7.50
MRPL, Mangalore	9.69	9.69	9.69	9.69	9.69
Sub total	32.19	32.19	32.19	32.19	35.19
Eastern Region					
IOC, Barauni	4.20	4.20	4.20	6.00	6.00
IOC, Haldia	4.60	4.60	4.60	4.60	6.00
IOC, Guwahati	1.00	1.00	1.00	1.00	1.00
IOC, Digboi	0.65	0.65	0.65	0.65	0.65
BR&PL, Bongaigaon	2.35	2.35	2.35	2.70	3.00
NRL, Numaligarh	3.00	3.00	3.00	3.00	3.00
Sub total	15.80	15.80	15.80	17.95	19.65
Western Region					
BPCL, Mumbai	6.90	6.90	6.90	6.90	12.00
HPCL, Mumbai	5.83	5.83	5.83	5.83	5.83
Reliance, Sikka	27.00	27.00	27.00	27.00	33.00
IOC, Koyali	13.70	13.70	13.70	13.70	18.00
Sub total	53.43	53.43	53.43	53.43	68.83
Total	**115.42**	**115.42**	**115.42**	**123.57**	**143.67**

Annexure 3.2

Expected refinery capacity (MMTPA) CASE 2

Refinery	2002/03	2003/04	2004/05	2005/06	2006/07
Northern Region					
IOC, Panipat	6.00	6.00	6.00	6.00	6.00
IOC, Mathura	8.00	8.00	8.00	8.00	8.00
Sub total	14.00	14.00	14.00	14.00	14.00
Southern Region					
MRL, Madras	6.00	6.00	6.00	6.00	9.00
CRL, Cochin	7.50	7.50	7.50	7.50	7.50
MRL, Nanmanam	1.50	1.50	1.50	1.50	1.50
HPCL, Vishakh	7.50	7.50	7.50	7.50	7.50
MRPL, Mangalore	9.69	9.69	9.69	9.69	9.69
Sub total	32.19	32.19	32.19	32.19	35.19
Eastern Region					
IOC, Barauni	4.20	4.20	4.20	6.00	6.00
IOC, Haldia	4.60	4.60	4.60	4.60	6.00
IOC, Guwahati	1.00	1.00	1.00	1.00	1.00
IOC, Digboi	0.65	0.65	0.65	0.65	0.65
BR&PL, Bongaigaon	2.35	2.35	2.35	2.70	3.00
NRL, Numaligarh	3.00	3.00	3.00	3.00	3.00
Sub total	15.80	15.80	15.80	17.95	19.65
Western Region					
BPCL, Mumbai	6.90	6.90	6.90	6.90	12.00
HPCL, Mumbai	5.83	5.83	5.83	5.83	5.83
Reliance, Sikka	27.00	27.00	27.00	27.00	33.00
IOC, Koyali	13.70	13.70	13.70	13.70	13.70
Sub total	53.43	53.43	53.43	53.43	64.53
Total	**115.42**	**115.42**	**115.42**	**123.57**	**133.37**

Annexure 3.3

Product pattern for the year 2000/01

	HP	VIZ	BPC	KRL	CPCL	CBDU	MAT	KOY	PAN	HAL	BAR	GUW	DIG	BRPL	NRL	ONGC	PSUTOTAL	MRPL	RPL	PVT/JV TOTAL	REF. PROD
LPG	13	287	342	305	141	21	208	318	152	54	88	19	10	30	35	0	2144	202	2296	2498	4642
Naphtha	63	597	978	596	707	148	487	1219	152	259	94	118	22	248	200	17	6477	480	2215	2695	9172
MS	24	765	860	740	351	0	826	930	700	210	438	18	73	45	0	0	6200	1202	2215	3417	9617
Others (LE)	9	36	162	75	37	0	23	23	0	0	0	0	0	8	0	0	462	0	2782	2782	3244
Sub-Total	**111**	**1685**	**2342**	**1716**	**1236**	**169**	**1544**	**2490**	**1004**	**523**	**620**	**155**	**105**	**331**	**235**	**17**	**15283**	**1884**	**9508**	**11392**	**26675**
ATF	44	36	250	91	328	0	453	540	215	200	0	0	0	70	71	0	2694	240	873	1113	3807
SKO	46	735	774	675	600	72	720	1210	590	149	385	75	44	162	223	13	6894	944	2431	3375	10269
HSD	136	2965	3027	2918	2052	264	3312	4351	2577	1356	1760	406	202	653	1569	8	28787	4796	10366	15162	43949
LDO	34	48	51	0	22	0	48	120	0	0	157	120	48	224	0	0	1182	0	0	0	1182
Others	4	36	126	0	60	0	0	73	24	95	0	1	11	0	0	0	474	0	0	0	474
Sub-Total	**266**	**3820**	**4228**	**3684**	**3062**	**336**	**4533**	**6294**	**3406**	**1800**	**2302**	**602**	**305**	**1109**	**1863**	**21**	**40031**	**5980**	**13670**	**19650**	**59681**
FO	86	455	523	944	932	0	603	423	0	880	0	0	95	0	24	0	5747	1235	0	1235	6982
LSHS	12	815	581	466	99	122	580	1723	460	0	111	6	0	66	0	6	5155	353	0	353	5508
Lubes	32	0	0	0	240	0	0	0	0	210	0	0	0	0			771	0	0	0	771
Bitumen	30	120	445	115	295	0	416	400	400	335	0	0	15	0	0	0	2841	200	0	200	3041
Others	7	27	10	20	92	0	37	15	28	83	165	62	62	162	64	0	901	25	2692	2717	3618
Sub-Total	**168**	**1417**	**1559**	**1545**	**1658**	**122**	**1636**	**2561**	**888**	**1508**	**276**	**68**	**172**	**228**	**88**	**6**	**15415**	**1813**	**2692**	**4505**	**19920**
Total Prod.	546	6922	8129	6945	5956	627	7713	11345	5298	3831	3198	825	582	1668	2186	44	70729	9677	25870	35547	106276
Gross F&L	41	579	525	555	547	37	516	815	502	365	301	76	64	131	315	8	5746	826	2053	2879	8625
ISD	1	0	0	0	0	0	4	-5	0	4	0	0	0	0	0	0	19	0	0	0	19
Grand Total	**588**	**7501**	**8654**	**7500**	**6503**	**664**	**8233**	**12155**	**5800**	**4200**	**3499**	**901**	**646**	**1799**	**2501**	**52**	**76494**	**10503**	**27923**	**38426**	**114920**

Annexure 3.4

SUPPLY OF LPG FROM FRACTIONATORS

		2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
NORTHERN		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
COMPANY	LOCATION											
EASTERN		**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**	**89**
COMPANY	LOCATION											
GAIL	LAKWA	52	52	52	52	52	52	52	52	52	52	52
OIL	DULIJAN	37	37	37	37	37	37	37	37	37	37	37
WESTERN		**1861**	**1760**	**1749**	**1683**	**1646**	**1620**	**1589**	**1560**	**1532**	**1505**	**1480**
COMPANY	LOCATION											
ONGC	URAN	469	408	419	397	371	352	339	327	315	304	293
	HAZIRA	582	546	527	488	488	488	474	461	449	436	424
	ANK	11	10	9	8	7	6	5	5	4	4	3
	GANDHAR	51	49	47	43	33	27	23	20	17	15	13
GAIL	VAGHODIA	50	50	50	50	50	50	50	50	50	50	50
	USAR	96	96	96	96	96	96	96	96	96	96	96
	AURIYA	178	178	178	178	178	178	178	178	178	178	178
	GANDHAR	143	143	143	143	143	143	143	143	143	143	143
	VIJAIPUR	280	280	280	280	280	280	280	280	280	280	280
SOUTHERN		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
COMPANY	LOCATION											
ALL INDIA		**1950**	**1849**	**1838**	**1772**	**1735**	**1709**	**1678**	**1649**	**1621**	**1594**	**1569**

Annexure 4.1 Projected refinery wise production of seven petroleum products for the years 2006/7 and 2011/12

Table 4.1.1 Projected production under the assumptions of Case 1 (TMT)

	2006/7							2011/12						
All figures in TMT	LPG	Naphtha	MS	HSD	ATF	FO/LSHS	SKO	LPG	Naphtha	MS	HSD	ATF	FO/LSHS	SK
Company														
BPCL-Mumbai	595	1959	1507	5123	452	2260	1205	595	1959	1507	5123	452	2260	120
HPCL-Mumbai	126	598	230	1286	388	930	439	126	598	230	1286	388	930	43
Reliance-Jamnagar	2578	2477	2487	11638	941	0	2729	2578	2477	2487	11638	941	0	272
IOC-Koyali	447	1710	1308	6121	684	3019	1702	447	1710	1308	6121	684	3019	170
Essar-Vadinar*	0	0	0	0	0	0	0	0	0	0	0	0	0	
BPCL/OOC-Bina*	0	0	0	0	0	0	0	0	0	0	0	0	0	
ONGC (Fractionator excluding LPG)	0	1160	0	0	0	0	177	0	851	0	0	0	0	17
Western Region Total	3747	7904	5532	24168	2464	6209	6253	3747	7595	5532	24168	2464	6209	625
HPCL-Bhatinda*														
IOC-Panipat	299	296	1376	5065	456	904	1160	299	296	1376	5065	456	904	116
IOC-Mathura	192	448	762	3057	456	1092	665	192	448	762	3057	456	1092	66
Northern Region Total	491	745	2138	8122	912	1996	1824	491	745	2138	8122	912	1996	182
IOC-Barauni	143	154	714	2867	0	181	627	143	154	714	2867	0	181	62
IOC-Haldia	73	353	285	1840	285	1194	202	73	353	285	1840	285	1194	20
IOC-Paradeep*	0	0	0	0	0	0	0	0	0	0	0	0	0	
Eastern Region Total	217	507	999	4707	285	1375	829	217	507	999	4707	285	1375	82

IOC-Guwahati	20	124	19	428	0	6	79	20	124	19	428	0	6	7
IOC-Digboi	10	21	70	193	0	91	42	10	21	70	193	0	91	4
BRPL-Bongaigaon	48	393	71	1034	114	105	257	48	393	71	1034	114	105	25
IBP/BPCL-Numaligarh	40	228	0	1788	86	27	254	40	228	0	1788	86	27	25
North-Eastern Region Total	117	767	160	3444	200	229	632	117	767	160	3444	200	229	63
MRL-Madras	185	932	461	2698	428	1356	789	185	932	461	2698	428	1356	78
CRL-Kochi	290	563	703	2772	71	1340	641	290	563	703	2772	71	1340	64
MRL-Narimanam	45	318	0	567	0	262	155	45	318	0	567	0	262	15
HPCL-Vizag	273	570	727	2816	0	1206	698	273	570	727	2816	0	1206	69
HPCL/Birla-Mangalore	177	423	1054	4204	184	1392	827	177	423	1054	4204	184	1392	82
Pennar-Cuddalore*	0	0	0	0	0	0	0	0	0	0	0	0	0	
ONGC - Tatipaka	0	26	0	12	0	8	20	0	26	0	12	0	8	2
Southern Region Total	970	2832	2945	13068	683	5563	3130	970	2832	2945	13068	683	5563	313
GRAND TOTAL	5541	12754	11773	53510	4544	15372	12669	5541	12446	11773	53510	4544	15372	1266

* represents grassroot refinery

BPCL Mumbai and Reliance Jamnagar are likely to further delayed into eleventh five year plan.

Barauni and Haldia are also likely to slip into eleventh five year plan.

Throughput of BPCL Mumbai refinery is based on actual 2000-01 data

Table 4.1.2 Projected production under the assumptions of Case 2 (TMT)

	2006/7							2011/12						
All figures in TMT	LPG	Naphtha	MS	HSD	ATF	FO/LSHS	SKO	LPG	Naphtha	MS	HSD	ATF	FO/LSHS	SKO
Company														
BPCL-Mumbai	595	1959	1507	5123	452	2260	1205	595	1959	1507	5123	452	2260	120
HPCL-Mumbai	126	598	230	1286	388	930	439	126	598	230	1286	388	930	43
Reliance-Jamnagar	2578	2477	2487	11638	941	0	2729	2578	2477	2487	11638	941	0	272
IOC-Koyali	340	1302	996	4659	521	2298	1296	340	1302	996	4659	521	2298	129
Essar-Vadinar*	0	0	0	0	0	0	0	0	0	0	0	0	0	
BPCL/OOC-Bina*	0	0	0	0	0	0	0	0	0	0	0	0	0	
ONGC (Fractionator excluding LPG)	0	1160	0	0	0	0	177	0	851	0	0	0	0	17
Western Region Total	3640	7495	5219	22706	2301	5488	5847	3640	7186	5219	22706	2301	5488	584
HPCL-Bhatinda*	0	0	0	0	0	0	0	0	0	0	0	0	0	
IOC-Panipat	149	148	688	2533	228	452	580	149	148	688	2533	228	452	58
IOC-Mathura	192	448	762	3057	456	1092	665	192	448	762	3057	456	1092	66
Northern Region Total	341	597	1450	5590	684	1544	1244	341	597	1450	5590	684	1544	124
IOC-Barauni	143	154	714	2867	0	181	627	143	154	714	2867	0	181	62
IOC-Haldia	73	353	285	1840	285	1194	202	73	353	285	1840	285	1194	20
IOC-Paradeep*	0	0	0	0	0	0	0	0	0	0	0	0	0	
Eastern Region Total	217	507	999	4707	285	1375	829	217	507	999	4707	285	1375	82
IOC-Guwahati	20	124	19	428	0	6	79	20	124	19	428	0	6	7
IOC-Digboi	10	21	70	193	0	91	42	10	21	70	193	0	91	4
BRPL-Bongaigaon	48	393	71	1034	114	105	257	48	393	71	1034	114	105	25
IBP/BPCL-Numaligarh	40	228	0	1788	86	27	254	40	228	0	1788	86	27	25

North-Eastern Region Total	117	767	160	3444	200	229	632	117	767	160	3444	200	229	63
MRL-Madras	185	932	461	2698	428	1356	789	185	932	461	2698	428	1356	78
CRL-Kochi	290	563	703	2772	71	1340	641	290	563	703	2772	71	1340	64
MRL-Narimanam	45	318	0	567	0	262	155	45	318	0	567	0	262	15
HPCL-Vizag	273	570	727	2816	0	1206	698	273	570	727	2816	0	1206	69
HPCL/Birla-Mangalore	177	423	1054	4204	184	1392	827	177	423	1054	4204	184	1392	82
Pennar-Cuddalore*	0	0	0	0	0	0	0	0	0	0	0	0	0	
ONGC - Tatipaka	0	26	0	12	0	8	20	0	26	0	12	0	8	2
Southern Region Total	970	2832	2945	13068	683	5563	3130	970	2832	2945	13068	683	5563	313
GRAND TOTAL	5285	12198	10773	49516	4152	14199	11683	5285	11889	10773	49516	4152	14199	1168

* represents grassroot refinery

BPCL Mumbai and Reliance Jamnagar are likely to further delayed into eleventh five year plan.

Barauni and Haldia are also likely to slip into eleventh five year plan.

Throughput of BPCL Mumbai refinery is based on actual 2000-01 data

Annexure 4.2

Depot-wise demand

Depots	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12
SriNagar	232	258	268	279	290	303	316	330	346	362	380
Jammu	166	191	200	210	221	233	245	259	273	288	305
Pathankot	184	219	231	244	258	273	288	306	324	344	365
Amritsar	252	296	312	330	349	369	391	414	439	466	495
Jullund	1015	1210	1280	1355	1436	1522	1614	1713	1819	1933	2054
Parwanoo	316	379	400	422	446	472	499	529	560	594	631
Kot Kapura	462	565	597	632	669	709	752	798	847	900	957
Chandigarh	155	175	186	199	212	226	241	256	273	291	311
Patiala	500	605	639	675	715	757	802	850	902	957	1017
Bathinda	213	262	277	293	310	329	349	370	393	418	444
Sangrur	269	317	335	355	376	399	424	450	478	508	540
Hanumangarh	160	193	203	213	225	237	251	265	281	297	315
Bikaner	163	198	209	220	232	245	259	273	289	307	325
Ambala	336	403	426	451	478	507	538	571	606	644	685
Hisar	426	526	556	588	623	660	700	743	789	838	891
Rewari	760	942	997	1056	1120	1188	1262	1341	1425	1516	1614
Kathgodam	193	233	245	258	272	287	303	320	339	359	380
Meerut	747	905	953	1005	1060	1120	1184	1253	1327	1407	1492
Saharanpur	331	388	408	429	451	475	501	528	558	590	624
Najibabad	118	139	146	153	160	168	177	186	196	207	219
Delhi	1909	2219	2355	2501	2657	2824	3002	3192	3395	3614	3846
Bharatpur	122	149	157	165	174	183	193	204	216	229	242
Agra	639	765	805	848	894	943	996	1053	1114	1179	1249
Bareilly	530	632	662	695	730	768	809	853	900	951	1005
Shahjahanpur	75	92	97	102	107	113	120	127	134	142	151
Panipat	644	793	838	887	940	996	1057	1122	1192	1267	1347
TOTAL	**10920**	**13052**	**13781**	**14563**	**15405**	**16305**	**17270**	**18304**	**19413**	**20606**	**21881**

Calculation of operating costs for Kandla Bhatinda Pipeline

Commisioning		1996/97	
Original capacity	TMT	6000	
Project cost	Rs Crores	2392	
For Ex Component (1993 prices)	Rs Crores	891	
Composite Works Contract	Rs Crores	1200	(For laying pipelines with other facilities)

Source: Capital costs -CAG; Operating costs- ETG

Parameters	Units	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	200
Depreciation	Rs/MT	293	248	210	178	151	128	108	92	77	66	5
Other Operating costs	Rs/MT	84	89	94	100	105	112	119	126	133	141	15
Variable expenses	Rs/MT	13	14	15	16	17	18	19	20	21	22	2
Salaries	Rs/MT	32	34	36	38	41	43	46	48	51	54	5
Repair & Maintenance	Rs/MT	11	11	12	13	14	14	15	16	17	18	1
Administraive expenses	Rs/MT	27	29	31	32	34	36	39	41	43	46	4
Margin	Rs/Mt	590	557	523	490	456	423	389	356	322	289	25
Total Cost	Rs/Mt	967	893	827	767	712	662	616	573	533	495	46

Depreciation Schedule

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	200
Depreciation @ 15.33% (WDV)	1913	1620	1372	1161	983	833	705	597	505	428	36
	293	248	210	178	151	128	108	92	77	66	5

Annexure

Interest Repayment

Loan outsanding	Rs Crores	1435	1292	1148	1005	861	718	574	431	287	144	
Interest @ 14%	Rs Crores	201	181	161	141	121	100	80	60	40	20	
Interest	Rs/MT	335	301	268	234	201	167	134	100	67	33	
ROE @ 16%	Rs/MT	255	255	255	255	255	255	255	255	255	255	25

Annexure 5.2

Calculation of operating costs of proposed HPCL pipeline

Particulars	Unit	Year														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Capital Cost	**Rs Crores**	**2353**	**2353**	**2353**	**2353**	**2353**	**2353**	**2353**	2353	2353	2353	2353	2353	2353	2353	2353
IDC	Rs Crores	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Total Cost	**Rs Crores**	2652	2652	2652	2652	2652	2652	2652	2652	2652	2652	2652	2652	2652	2652	2652
Throughput	**TMT**	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000	9000
Costs																
Fixed Cost																
Interest	Rs Crores	223	200	178	156	134	111	89	67	45	22	0	0	0	0	0
O&M Charges	Rs Crores	95	100	104	109	115	120	126	132	138	145	152	159	167	175	183
Depreciation	Rs Crores	391	331	281	238	201	170	144	122	103	88	74	63	53	45	38
ROE	Rs Crores	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
Taxes	Rs Crores	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106
Total Fixed Cost	**Rs Crores**	**985**	**907**	**839**	**779**	**725**	**678**	**635**	**597**	**562**	**531**	**502**	**498**	**496**	**496**	**497**
Fixed cost/unit	**Rs/MT**	**1095**	**1008**	**932**	**865**	**806**	**753**	**706**	**663**	**625**	**590**	**558**	**553**	**551**	**551**	**553**
Operating cost/unit	**Rs/MT**	**106**	**111**	**116**	**122**	**127**	**134**	**140**	**147**	**154**	**161**	**169**	**177**	**185**	**194**	**204**
TARIFF	**Rs/MT**	**1095**	**1008**	**932**	**865**	**806**	**753**	**706**	**663**	**625**	**590**	**558**	**553**	**551**	**551**	**553**
PV Factor		1.00	0.87	0.76	0.66	0.58	0.50	0.44	0.38	0.33	0.29	0 25	0.22	0.19	0.17	0.14
PV of tariff		1095	878	707	572	464	378	308	252	207	170	140	121	105	92	80
Levelised Tarif	**Rs/MT**	**944**														
REPAYMENT SCHEDULE																
Loan outstanding at beginning of year	Rs Crores	1591	1432	1273	1114	955	796	636	477	318	159					
Interest	Rs Crores	223	200	178	156	134	111	89	67	45	22					
Repayment	Rs Crores	159	159	159	159	159	159	159	159	159	159					

Loan outstanding at end of year	Rs Crores	1432	1273	1114	955	796	636	477	318	159	0					
REPAYMENT SCHEDULE																
Plant & Machinery																
Asset value at beginning of year	Rs Crores	2550	2159	1828	1548	1311	1110	940	796	674	570	483	409	346	293	248
Depreciation	Rs Crores	391	331	280	237	201	170	144	122	103	87	74	63	53	45	38
Land, buildings, etc																
Asset value at beginning of year	Rs Crores	3.2	3	3	2	2	2	2	2	1	1	1	1	1	1	1
Depreciation	Rs Crores	0.319	0.288	0.259	0.233	0.210	0.189	0.170	0.153	0.138	0.124	0.111	0.100	0.090	0.081	0.073
Township																
Asset Value	Rs Crores	3.491606	3.317	3.260	3.203	3.146	3.089	3.032	2.976	2.919	2.862	2.805	2.748	2.691	2.634	2.577
Depreciation	Rs Crores	0.175	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
P&L ACCOUNT																
Revenues	Rs Crores	**985**	**907**	**839**	**779**	**725**	**678**	**635**	**597**	**562**	**531**	**502**	**498**	**496**	**496**	**497**
Less. O&M Expenses	Rs Crores	95	100	104	109	115	120	126	132	138	145	152	159	167	175	183
Total	Rs Crores	95	100	104	109	115	120	126	132	138	145	152	159	167	175	183
PBDIT	Rs Crores	**890**	**808**	**735**	**669**	**611**	**558**	**509**	**465**	**424**	**386**	**350**	**339**	**329**	**321**	**314**
Less																
Interest	Rs Crores	223	200	178	156	134	111	89	67	45	22	0	0	0	0	0
Depreciation	Rs Crores	391	331	281	238	201	170	144	122	103	88	74	63	53	45	38
Tax	Rs Crores	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106
Net profit	Rs Crores	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**	**170**
Calculation of Taxes																
PBDIT-Int-Dep	Million	276	276	276	276	276	276	276	276	276	276	276	276	276	276	276
Corporate Tax	Million	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106

Annexure 5.3

Landed price of HSD at various depots from various supply sources considered in Case 1.

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda
SriNagar	13961	14119	14483	14683
Jammu	13373	13531	13895	14095
Pathankot	13242	13400	13765	13958
Amritsar	13198	13356	13720	13638
Jullunder	13032	13190	13554	13797
Parwanoo	13094	13252	13616	13943
Kot Kapura	13165	13323	13688	13599
Chandigarh	12982	13140	13504	13831
Patiala	12984	13142	13506	13668
Bathinda	13061	13219	13584	13420
Sangrur	12975	13134	13498	13599
Hanumangarh	13249	13407	13772	13663
Bikaner	13482	14432	14796	14035
Ambala	12890	13048	13412	13739
Hisar	13073	13231	13596	13883
Rewari	12910	13267	13632	13853
Kathgodam	13119	13652	14016	14434
Meerut	12850	13053	13417	13899
Saharanpur	13130	13288	13652	14171
Najibabad	13335	13462	13826	14306
Delhi	12720	13131	13496	13853
Bharatpur	12680	13553	13917	14149
Agra	12708	13377	13741	14177
Bareilly	12929	13462	13826	14244
Shahjahanpur	13119	13553	13917	14350
Panipat	12795	12953	13318	13883

Annexure 5.4

Landed price of HSD at various depots from various supply sources considered in Case 2.

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda
SriNagar	13961	14119	14670	14683
Jammu	13373	13531	14082	14095
Pathankot	13242	13400	13951	13958
Amritsar	13198	13356	13857	13638
Jullunder	13032	13190	13741	13797
Parwanoo	13094	13252	13838	13943
Kot Kapura	13165	13323	13905	13599
Chandigarh	12982	13140	13726	13831
Patiala	12984	13142	13677	13668
Bathinda	13061	13219	13801	13420
Sangrur	12975	13134	13715	13599
Hanumangarh	13249	13407	13989	13663
Bikaner	13482	14432	13602	14035
Ambala	12890	13048	13634	13739
Hisar	13073	13231	13819	13883
Rewari	12910	13267	13395	13853
Kathgodam	13119	13652	14421	14434
Meerut	12850	13053	13663	13899
Saharanpur	13130	13288	13874	14171
Najibabad	13335	13462	13964	14306
Delhi	12720	13131	13533	13853
Bharatpur	12680	13553	13601	14149
Agra	12708	13377	13723	14177
Bareilly	12929	13462	14231	14244
Shahjahanpur	13119	13553	14335	14350
Panipat	12795	12953	13541	13883

Annexure 5.5

Depots likely to be served by Bhatinda refinery in various year in Case-1

Table 5.5.1 Depots likely to be served by Bhatinda refinery in 2007/8 under Case 1 (TMT)

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda	Dummy
SriNagar	0	0	0	316	0
Jammu	0	0	0	245	0
Pathankot	0	0	0	288	0
Amritsar	0	0	0	391	0
Jullunder	0	0	1614	0	0
Parwanoo	0	0	499	0	0
Chandigarh	0	241	0	0	0
Bathinda	0	0	0	1101	0
Sangrur	0	1075	0	0	0
Hanumangarh	0	0	0	251	0
Bikaner	0	0	0	259	0
Ambala	0	538	0	0	0
Hisar	0	0	700	0	0
Rewari	0	0	837	425	0
Kathgodam	0	0	0	303	0
Meerut	0	1184	0	0	0
Saharanpur	0	0	0	501	0
Najibabad	0	0	0	177	0
Delhi	3002	0	0	0	0
Bharatpur	193	0	0	0	0
Agra	996	0	0	0	0
Bareilly	0	0	0	809	0
Shahjahanpur	0	0	0	120	0
Panipat	293	763	0	0	0
Total Sales	4484	3800	3800	5185	0
Total Demand	4484	3800	3800	6750	10000
Capacity Utilisation	100%	100%	100%	77%	0%

Table 5.5.2 Depots likely to be served by Bhatinda refinery in 2008/9 under Case 1 (TMT)

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda	Dummy
SriNagar	0	0	0	330	0
Jammu	0	0	0	259	0
Pathankot	0	0	0	306	0
Amritsar	0	0	0	414	0
Jullunder	0	0	1713	0	0
Parwanoo	0	0	529	0	0
Chandigarh	0	256	0	0	0
Bathinda	0	0	0	1168	0
Sangrur	0	634	0	0	0
Hanumangarh	0	0	0	265	0
Bikaner	0	0	0	273	0
Ambala	0	571	0	0	0
Hisar	0	0	743	0	0
Rewari	0	0	151	1190	0
Kathgodam	0	0	0	320	0
Meerut	0	1253	0	0	0
Saharanpur	0	0	0	528	0
Najibabad	0	0	0	186	0
Delhi	3192	0	0	0	0
Bharatpur	204	0	0	0	0
Agra	1053	0	0	0	0
Bareilly	0	0	0	853	0
Shahjahanpur	0	0	0	127	0
Panipat	36	1086	0	0	0
Total Sales	4484	3800	3800	6219	0
Total Supply	4484	3800	3800	6750	10000
Capacity Utilisation	100%	100%	100%	92%	0%

Table 5.5.3 Depots likely to be served by Bhatinda refinery in 2009/10 under Case 1 (TMT)

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda	Dummy
SriNagar	0	0	0	0	346
Jammu	0	0	0	273	0
Pathankot	0	0	0	324	0
Amritsar	0	0	0	439	0
Jullunder	0	0	1819	0	0
Parwanoo	0	0	0	560	0
Chandigarh	0	0	273	0	0
Bathinda	0	0	0	1240	0
Sangrur	0	435	944	0	0
Hanumangarh	0	0	0	281	0
Bikaner	0	0	0	289	0
Ambala	0	606	0	0	0
Hisar	0	0	764	24	0
Rewari	0	0	0	1425	0
Kathgodam	0	0	0	106	232
Meerut	0	1327	0	0	0
Saharanpur	0	0	0	558	0
Najibabad	0	0	0	196	0
Delhi	3155	240	0	0	0
Bharatpur	216	0	0	0	0
Agra	1114	0	0	0	0
Bareilly	0	0	0	900	0
Shahjahanpur	0	0	0	134	0
Panipat	0	1192	0	0	0
Total Sales	4484	3800	3800	6750	578
Total Supply	4484	3800	3800	6750	10000
Capacity Utilisation	100%	100%	100%	100%	6%

Table 5.5.4 Depots likely to be served by Bhatinda refinery in 2010/11 under Case 1 (TMT)

DEPOTS	Mathura	Panipat Existing	Panipat Expansion	Bhatinda	Dummy
SriNagar	0	0	0	0	**362**
Jammu	0	0	0	288	0
Pathankot	0	0	0	344	0
Amritsar	0	0	0	466	0
Jullunder	0	0	1933	0	0
Parwanoo	0	0	0	594	0
Chandigarh	0	0	291	0	0
Bathinda	0	0	0	1318	0
Sangrur	0	0	1465	0	0
Hanumangarh	0	0	0	297	0
Bikaner	0	0	0	307	0
Ambala	0	644	0	0	0
Hisar	0	0	57	781	0
Rewari	0	0	0	1516	0
Kathgodam	0	0	0	0	**359**
Meerut	0	1407	0	0	0
Saharanpur	0	0	0	590	0
Najibabad	0	0	0	0	**207**
Delhi	3077	483	54	0	0
Bharatpur	229	0	0	0	0
Agra	1179	0	0	0	0
Bareilly	0	0	0	250	**700**
Shahjahanpur	0	0	0	0	**142**
Panipat	0	1267	0	0	0
Total Sales	4484	3800	3800	6750	**1771**
Total Supply	4484	3800	3800	6750	10000
Capacity Utilisation	100%	100%	100%	100%	**18%**

Annexure 5.6

Depots likely to be served by Bhatinda refinery in various year in Case-2

Table 5.6.1 Depots likely to be served by Bhatinda refinery in 2007/8 under Case 2 (TMT)

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda	Dummy
SriNagar	0	0	0	316	0
Jammu	0	0	0	245	0
Pathankot	0	0	0	288	0
Amritsar	0	0	0	391	0
Jullunder	0	0	1614	0	0
Parwanoo	0	0	0	499	0
Chandigarh	0	241	0	0	0
Patiala	0	651	0	151	0
Bathinda	0	0	0	1853	0
Sangrur	0	424	0	0	0
Hanumangarh	0	0	0	251	0
Bikaner	0	0	259	0	0
Ambala	0	538	0	0	0
Hisar	0	0	160	539	0
Rewari	0	0	1262	0	0
Kathgodam	0	0	0	303	0
Meerut	0	1184	0	0	0
Saharanpur	0	0	0	501	0
Najibabad	0	0	0	177	0
Delhi	3002	0	0	0	0
Bharatpur	193	0	0	0	0
Agra	996	0	0	0	0
Bareilly	0	0	0	809	0
Shahjahanpur	0	0	0	120	0
Panipat	293	763	0	0	0
Total Sales	4484	3800	3295	5690	0
Total Supply	4484	3800	3295	6750	10000
Capacity Utilisation	100%	100%	100%	84%	0%

Table 5.6.2 Depots likely to be served by Bhatinda refinery in 2008/9 under Case 2 (TMT)

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda	Dummy
SriNagar	0	0	0	107	224
Jammu	0	0	0	259	0
Pathankot	0	0	0	306	0
Amritsar	0	0	0	414	0
Jullunder	0	0	1432	281	0
Parwanoo	0	0	0	529	0
Chandigarh	0	256	0	0	0
Patiala	0	184	0	666	0
Bathinda	0	0	0	1168	0
Sangrur	0	450	0	0	0
Hanumangarh	0	0	0	265	0
Bikaner	0	0	273	0	0
Ambala	0	571	0	0	0
Hisar	0	0	0	743	0
Rewari	0	0	1341	0	0
Kathgodam	0	0	0	320	0
Meerut	0	1253	0	0	0
Saharanpur	0	0	0	528	0
Najibabad	0	0	0	186	0
Delhi	3192	0	0	0	0
Bharatpur	204	0	0	0	0
Agra	1053	0	0	0	0
Bareilly	0	0	0	853	0
Shahjahanpur	0	0	0	127	0
Panipat	36	1086	0	0	0
Total Salles	4484	3800	3046	6750	224
Total Supply	4484	3800	3046	6750	10000
Capacity Utilisation	100%	100%	100%	100%	2%

Table 5.6.3 Depots likely to be served by Bhatinda refinery in 2009/10 under Case 2 (TMT)

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda	Dummy
SriNagar	0	0	0	0	346
Jammu	0	0	0	273	0
Pathankot	0	0	0	324	0
Amritsar	0	0	0	439	0
Jullunder	0	0	790	1029	0
Parwanoo	0	0	0	560	0
Chandigarh	0	0	273	0	0
Patiala	0	0	0	902	0
Bathinda	0	0	0	1240	0
Sangrur	0	435	0	42	0
Hanumangarh	0	0	0	281	0
Bikaner	0	0	289	0	0
Ambala	0	606	0	0	0
Hisar	0	0	0	789	0
Rewari	0	0	1425	0	0
Kathgodam	0	0	0	0	339
Meerut	0	1327	0	0	0
Saharanpur	0	0	0	558	0
Najibabad	0	0	0	0	196
Delhi	3155	240	0	0	0
Bharatpur	216	0	0	0	0
Agra	1114	0	0	0	0
Bareilly	0	0	0	314	585
Shahjahanpur	0	0	0	0	134
Panipat	0	1192	0	0	0
Total Sales	4484	3800	2778	6750	1600
Total Supply	4484	3800	2778	6750	10000
Capacity Utilisation	100%	100%	100%	100%	16%

Table 5.6.4 Depots likely to be served by Bhatinda refinery in 2010/11 under Case 2 (TMT)

DEPOTS	Mathura	Panipat Existing	KBPL	Bhatinda	Dummy
SriNagar	0	0	0	0	362
Jammu	0	0	0	0	288
Pathankot	0	0	0	161	182
Amritsar	0	0	0	466	0
Jullunder	0	0	322	1611	0
Parwanoo	0	0	0	594	0
Chandigarh	0	0	291	0	0
Patiala	0	0	0	957	0
Bathinda	0	0	0	1318	0
Sangrur	0	0	0	508	0
Hanumangarh	0	0	0	297	0
Bikaner	0	0	307	0	0
Ambala	0	644	0	0	0
Hisar	0	0	0	838	0
Rewari	0	0	1516	0	0
Kathgodam	0	0	0	0	359
Meerut	0	1407	0	0	0
Saharanpur	0	0	0	0	590
Najibabad	0	0	0	0	207
Delhi	3077	483	54	0	0
Bharatpur	229	0	0	0	0
Agra	1179	0	0	0	0
Bareilly	0	0	0	0	951
Shahjahanpur	0	0	0	0	142
Panipat	0	1267	0	0	0
Total Sales	4484	3800	2490	6750	3081
Total Supply	4484	3800	2490	6750	10000
Capacity Utilisation	100%	100%	100%	100%	31%